The NUBASE evaluation of nuclear and decay properties

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Abstract

This paper presents the NUBASE evaluation of nuclear and decay properties of nuclides in their ground- and isomeric-states. All nuclides for which some experimental information is known are considered. NUBASE uses extensively the information given by the "Evaluated Nuclear Structure Data Files" and includes the masses from the "Atomic Mass Evaluation" (AME, second part of this issue). But it also includes information from recent literature and is meant to cover all experimental data along with their references. In case no experimental data is available, trends in the systematics of neighboring nuclides have been used, whenever possible, to derive estimated values (labeled in the database as non-experimental). Adopted procedures and policies are presented.

AMDC: http://csnwww.in2p3.fr/AMDC/

1. Introduction

The present evaluation responds to the needs expressed by the nuclear physics community, from fundamental physics to applied nuclear sciences, for a database which contains values for the main basic nuclear properties such as masses, excitation energies of isomers, half-lives, spins and parities, decay modes and their intensities. A

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requirement is that all the information should be properly referenced in that database to allow checks on their validity.

One of the applications of such a database is the "Atomic Mass Evaluation" (AME) in which it is essential to have clear identification of the states involved in a decay, a reaction or a mass-spectrometric line. This is the main reason for which these two evaluations are coupled in the present issue. Furthermore, calculations requiring radioactive parameters for nuclear applications (e.g. reactors, waste management, nuclear astrophysics) need to access this basic information on any nuclide. In the preparation of a nuclear physics experiment, such a database could also be quite useful.

Most of the data mentioned above are in principle already present in two evaluated files: the "Evaluated Nuclear Structure Data Files" (ENSDF) [1] and the "Atomic Mass Evaluation" (AME2003, second part of this issue). The demand for a database as described above could be thus partially fulfilled by combining them in a 'horizontal' structure (which exists in the AME, but not in ENSDF). NUBASE is therefore, at a first level, a critical compilation of these two evaluations.

While building NUBASE, we found it necessary to examine the literature, firstly, to revise several of the collected results in ENSDF and ensure that the mentioned data are presented in a more consistent way; secondly, to have as far as possible all the available experimental data included, not only the recent ones (updating requirement), but also those missed in ENSDF (completeness requirement). This implied some evaluation work, which appears in the remarks added in the NUBASE table and in the discussions below. Full references are given for all of the added experimental information (cf. Section 2.7).

There is no strict cut-off date for the data from literature used in the present NUBASE2003 evaluation: all data available to us until the material was sent (November 19, 2003) to the publisher have been included. Those which could not be included for special reasons, like the need for a heavy revision of the evaluation at a too late stage, are added in remarks to the relevant data.

The contents of NUBASE are described below, along with some of the policies adopted in this work. Updating procedures of NUBASE are presented in Section 3. Finally, the electronic distribution of NUBASE and an interactive display of its contents with a World Wide Web Java program or with a PC-program are described in Section 4.

The present publication updates and includes all the information given in the previous and very first evaluation of NUBASE [2], published in 1997.

2. Contents of NUBASE

NUBASE contains experimentally known nuclear properties together with some values estimated by extrapolation of experimental data for 3177 nuclides. NUBASE also contains data on isomeric states. We presently know 977 nuclides having one or more excited isomers according to our definition below. In the present evaluation we extended the definition of isomers compared to NUBASE'97 where only states with half-lives greater than 1 millisecond were considered. In present mass spectrometric experiments performed at accelerators, with immediate detection of the produced nuclei, isomers with half-lives as short as 100 ns may be present in the detected signals. We aimed at including as much as possible all those which play or might play in the near future a *rôle* in such experiments. We include also the description of those states that are involved in mass measurements and thus enter the AME2003.

For each nuclide (A,Z), and for each state (ground or excited isomer), the following quantities have been compiled, and when necessary evaluated: mass excess, excitation energy of the excited isomeric states, half-life, spin and parity, decay modes and intensities for each mode, isotopic abundances of the stable nuclei, and references for all experimental values of the above items.

In the description below, references to papers that are also quoted in the NUBASE table are given with the same Nuclear Structure Reference key number style [3]. They are listed at the end of this issue (AME2003, Part II, p. 579).

In NUBASE'97, the names and the chemical symbols used for elements 104 to 109 were those recommended then by the Commission on Nomenclature of Inorganic Chemistry of the International Union of Pure and Applied Chemistry (IUPAC). Since then, unfortunately for the resulting confusion, the names were changed and moreover two of them were displaced [4] (see also AME2003, Part I, Section 6.5). The user should therefore be careful when comparing results between NUBASE'97 and the present NUBASE2003 for nuclides with $Z \geq 104$. The finally adopted names and symbols are: 104 rutherfordium (Rf), 105 dubnium (Db), 106 seaborgium (Sg), 107 bohrium (Bh), 108 hassium (Hs), and 109 meitnerium (Mt), while the provisional symbols Ea, Eb, ..., Ei are used for elements 110, 111, ..., 118.

Besides considering all nuclides for which at least one piece of information is experimentally available, we also included unknown nuclides - for which we give estimated properties - in order to ensure continuity of the set of the considered nuclides at the same time in N, in Z, in A and in $N-Z$. The chart of the nuclides defined this way has a smooth contour.

As far as possible, one standard deviations (1 σ) are given to represent the uncertainties connected with the experimental values. Unfortunately, authors do not always define the meaning of the uncertainties they quote; under such circumstances, the uncertainties are assumed to be one standard deviations. In many cases, the uncertainties are not given at all; we then estimated them on the basis of the limitations of the method of measurement.

Values and errors that are given in the NUBASE table have been rounded, even if unrounded values were found in ENSDF or in the literature. In cases where the two furthest-left significant digit in the error were larger than a given limit (30 for the energies, to maintain strict identity with AME2003, and 25 for all other quantities), values and errors were rounded off (see examples in the 'Explanation of table'). In very few cases, when essential for traceability, we added a remark with the original value.

When no experimental data exist for a nuclide, values can often be estimated from observed trends in the systematics of experimental data. In the AME2003, masses estimated from systematic trends were already flagged with the symbol '#'. The use of this symbol has been extended in NUBASE to all other quantities and has the same meaning of indicating non-experimental information.

2.1. Mass excess

The mass excess is defined as the difference between the atomic mass (in mass units) and the mass number, and is given in keV for each nuclear state, together with its one standard deviation uncertainty. The mass excess values given in NUBASE are exactly those of the AME2003 evaluation, given in the second part of this issue.

It sometimes happens that knowledge of masses can yield information on the decay modes, in particular regarding nucleon-stability. Such information has been used here, as can be seen in the table for ^{10}He, ^{19}Na, ^{39}Sc, ^{62}As or ^{63}As. In some cases we rejected claimed observation of decay modes, when not allowed by energetic consideration. As an example, ENSDF2000 compiles for ^{142}Ba five measurements of delayed neutron decay intensities, whereas $Q(\beta^-\mathrm{n}) = -2955(7)$ keV.

Figure 1 complements the main table in displaying the precisions on the masses, in a color-coded chart, as a function of N and Z.

2.2. Isomers

In the first version of NUBASE in 1997 [2], a simple definition for the excited isomers was adopted: they were states that live longer than 1 millisecond. Already in NUBASE97, we noticed that such a simple definition had several drawbacks, particularly for alpha and proton decaying nuclides: whereas for β-decay a limit of 1 millisecond was acceptable (the shortest-lived known β-decaying nuclide (^{35}Na) has a half-life of 1.5 millisecond), for α or proton decay, several cases are known where an isomer with a half-life far below 1 millisecond lives still longer than the ground-state.

As mentioned earlier, the definition of isomers is now extended to include a large number of excited states, with half-lives as short as 100 ns, that are of interest for mass spectrometric works at accelerators. Isomers are given in order of increasing excitation energy and identified by appending '*m*', '*n*', '*p*' or '*q*' to the nuclide name, e.g. ^{90}Nb for the ground-state, ^{90}Nb^m for the first excited isomer, ^{90}Nb^n for the second

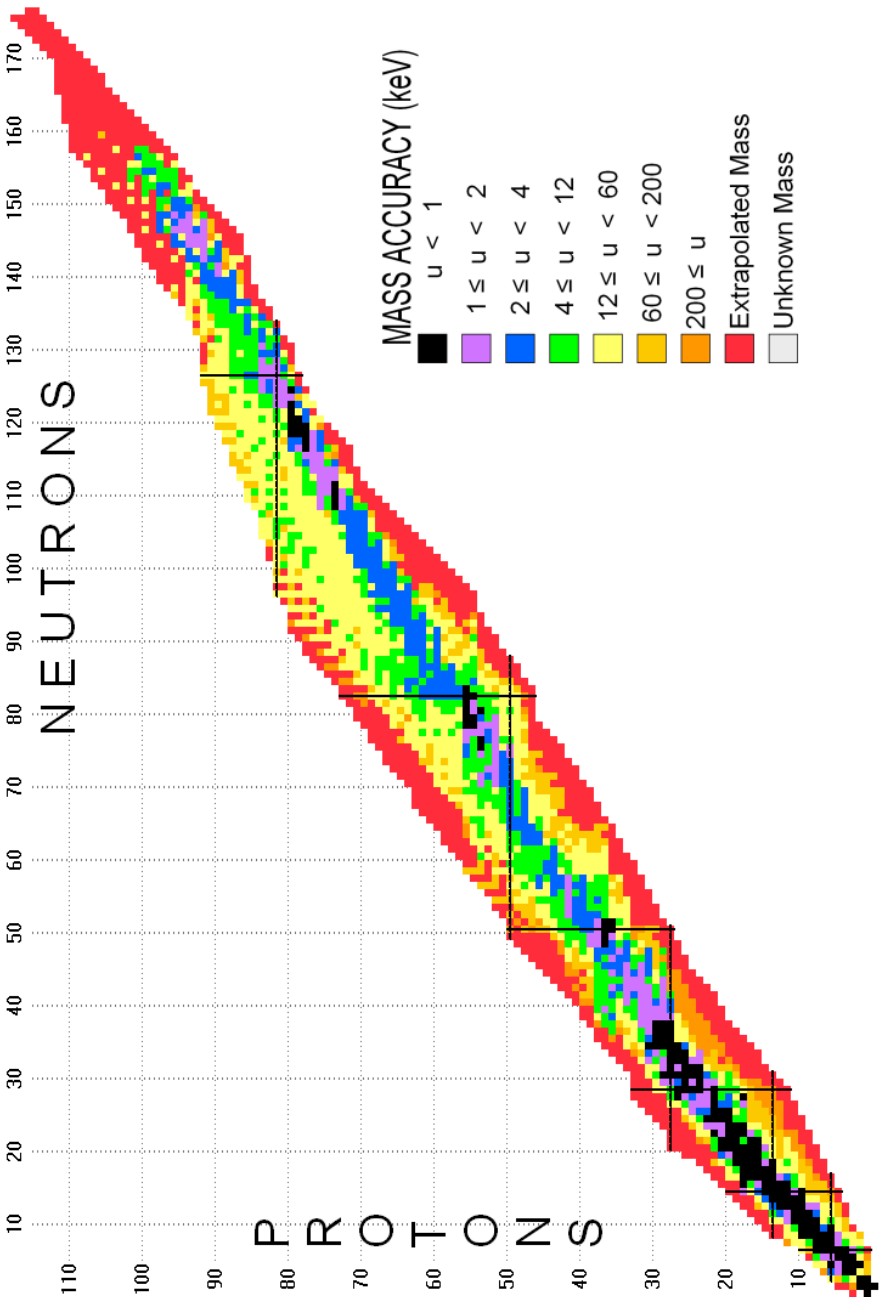

Figure 1: Chart of the nuclides for the precision 'u' on masses (created by NUCLEUS-AMDC).

one, ^{90}Nb^p and ^{90}Nb^q for respectively the third and fourth. In NUBASE97 we could not report in a normal way the third excited isomer of ^{178}Ta with half-life 59 ms, because of poorness of notation; the new notation adopted here removes also such a limitation.

The excitation energy can be derived from a number of different experimental methods. When this energy is derived from a method other than γ-ray spectrometry, the origin is indicated by a two-letter code and the numerical value is taken from AME. Otherwise, the code is left blank and the numerical value is taken from ENSDF or from literature update.

When the existence of an isomer is under discussion (e.g. ^{141}Tb^m) it is flagged with 'EU' in the origin field to mean "existence uncertain". A comment is generally added to indicate why its existence is questioned, or where this matter has been discussed. Depending on the degree of our confidence in this existence, we can still give a mass excess value and an excitation energy, or omit them altogether (e.g. ^{138}Pm^n). In the latter case, the mention "non-existent" appears in place of that excitation energy.

When an isomer has been reported, and later proved not to exist (e.g. ^{184}Lu^m), it is flagged with 'RN' in the origin field to mean "reported, non-existent". In such case we give of course no mass excess value and no excitation energy, and, as in the case of the 'EU's above, they are replaced by the same mention "non-existent".

Note: we have extended the use of the two flags 'EU' and 'RN' to cases where the discovery of a nuclide (e.g. ^{260}Fm) is questioned. In this case however we always give an estimate, derived from systematic trends, for the ground state masses.

In several cases, ENSDF gives a lower and a higher limit for an isomeric excitation energy. A uniform distribution of probabilities has been assumed which yields a value at the middle of the range and a 1σ uncertainty of 29% of that range (cf. Appendix B of the AME2003, Part I, for a complete description of this procedure). An example is ^{136}La for which it is known that the excited isomer lies above the level at 230.1 keV, but, as explained in ENSDF, there are good experimental indications that the difference between these two levels lies between 10 and 40 keV. We present this information as $E = 255(9)$ keV. However, if that difference would have been derived from theory or from systematics, the resulting E is considered as non-experimental and the value flagged with the '#' symbol.

In case that the uncertainty σ on the excitation energy E is relatively large compared to the value, the assignment to ground state and isomeric state is uncertain. If $\sigma > E/2$ a flag is added in the NUBASE table.

As a result of this work, the orderings of several ground-states and isomeric-states have been reversed compared to those in ENSDF. They are flagged in the NUBASE table with the '&' symbol. In several cases we found evidence for a state below the adopted ENSDF ground-state. Also, in many other cases, the systematics of nuclides with the same parities in N and Z strongly suggest that such a lower state should exist.

They have been added in the NUBASE table and can be located easily, since they are also flagged with the '&' symbol. In a few cases, new information on masses can also lead to reversal of the level ordering. Thanks to the coupling of the NUBASE and the AME evaluations, all changes in level ordering are carefully synchronized.

News on isomeric excitation energies

Interestingly, the technique of investigating proton decay of very proton-rich nuclides gives information on isomeric excitation energies. Thus, such work on ^{167}Ir [1997Da07] shows that it has an isomeric excitation energy $E = 175.3(2.2)$ keV. This information is displayed by the 'p' symbol following the excitation energy. In addition, study of the α-decay series of these activities not only showed that a number of α lines earlier assigned to ground-states belong in reality to isomers, but also allowed to derive values for their excitation energies.

Another case of such a change is ^{181}Pb. The α decay half-life that was previouly assigned to ^{181}Pb^m is now assigned to the ground-state, following the work of Toth *et al.* [1996To01] who showed, first, that contrary to a previous work, there is no α line at higher energy than the one just mentioned, and second, that the observed α is in correlation with the decay of the daughter ^{177}Hg, which is also most probably a $5/2^-$ state.

2.3. Half-life

For some light nuclei, the half-life ($T_{1/2}$) is deduced from the level total width ($\Gamma_{\rm cm}$) by the equation $\Gamma_{\rm cm}\, T_{1/2} \simeq \hbar \ln 2$:

$$T_{1/2}\,(\mathrm{s}) \simeq 4.562\,10^{-22}/\Gamma_{\rm cm}\,(\mathrm{MeV}).$$

Quite often uncertainties for half-lives are given asymmetrically T^{+a}_{-b}. If these uncertainties are used in some applications, they need to be symmetrized. Earlier (cf. AME'95) a rough symmetrization was used: take the central value to be the mid-value between the upper and lower 1σ-equivalent limits $T + (a-b)/2$, and define the uncertainty to be the average of the two uncertainties $(a+b)/2$. A strict statistical derivation (see Appendix) shows that a better approximation for the central value is obtained by using $T + 0.64 \times (a-b)$. The exact expression for the uncertainty is given in the Appendix.

When two or more independent measurements have been reported, they are averaged, while being weighed by their reported precision. While doing this, we consider the NORMALIZED CHI, χ_n (or 'consistency factor' or 'Birge ratio'), as defined in AME2003, Part I, Section 5.2. Only when χ_n is beyond 2.5, do we depart from the statistical result, and adopt the external error for the average, following the same policy as discussed and adopted in AME2003, Part I, Section 5.4. Very rarely, when the Birge ratio χ_n is so large that we consider all errors given as non-relevant, do we adopt the arithmetic average (unweighed) for the result and the corresponding error (based on the dispersion of values). In all such cases, a remark is added to the data, giving the list of values that were averaged, and, when relevant, the value of the Birge ratio χ_n and the reason for our choice.

In the case of experiments in which extremely rare events are observed, and where the results are very asymmetric, we did not average directly the half-lives derived from different works, but instead, when the information given in the papers was sufficient (e.g. ^{264}Hs or ^{269}Hs), we combined the delay times of the individual events, as prescribed by Schmidt *et al* [1984Sc13].

Some measurements are reported as a range of values with most probable lower and upper limits. They are treated, as explained above (cf. Section 2.2), as a uniform distribution of probabilities with a value at the middle of the range and a 1σ uncertainty of 29% of that range (cf. Appendix B of the AME2003 for a complete description of this procedure).

For some nuclides identified by using a time-of-flight spectrometer, an upper or a lower limit on the half-life is given.
i) For *observed* species, we give this important but isolated piece of information (lower limit) in place of the uncertainty on the half-life, and within brackets (e.g. ^{36}Mg, p. 34). The user of our table should be careful in that this limit can be very far below the eventually measured half-life. To help to avoid confusion, we now give, in addition, an estimate (as always in the present two evaluations, flagged with #) for the half-life derived from trends in systematics.
ii) For nuclides sought for but *not observed*, we give the found upper limit in place of the half-life. Upper limits for undetected nuclides have been evaluated for NUBASE by F. Pougheon [1993Po.A], based on the time-of-flight of the experimental setup and the yields expected from the trends in neighboring nuclides (e.g. ^{19}Na).

When half-lives for nuclides with the same parities in Z and N are found to vary smoothly (see Fig. 2), interpolation or extrapolation is used to obtain reasonable estimates.

2.4. Spin and parity

As in ENSDF, values are presented without and with parentheses based upon strong and weak assignment arguments, respectively (see the introductory pages of Ref. [5]). Unfortunately, the latter include estimates from systematics or theory. Where we can distinguish them, we use parentheses if the so-called “weak” argument is an experimental one, but the symbol ‘#’ in the other cases. The survey might have not been complete, and the reader might still find non-flagged non-experimental cases (the

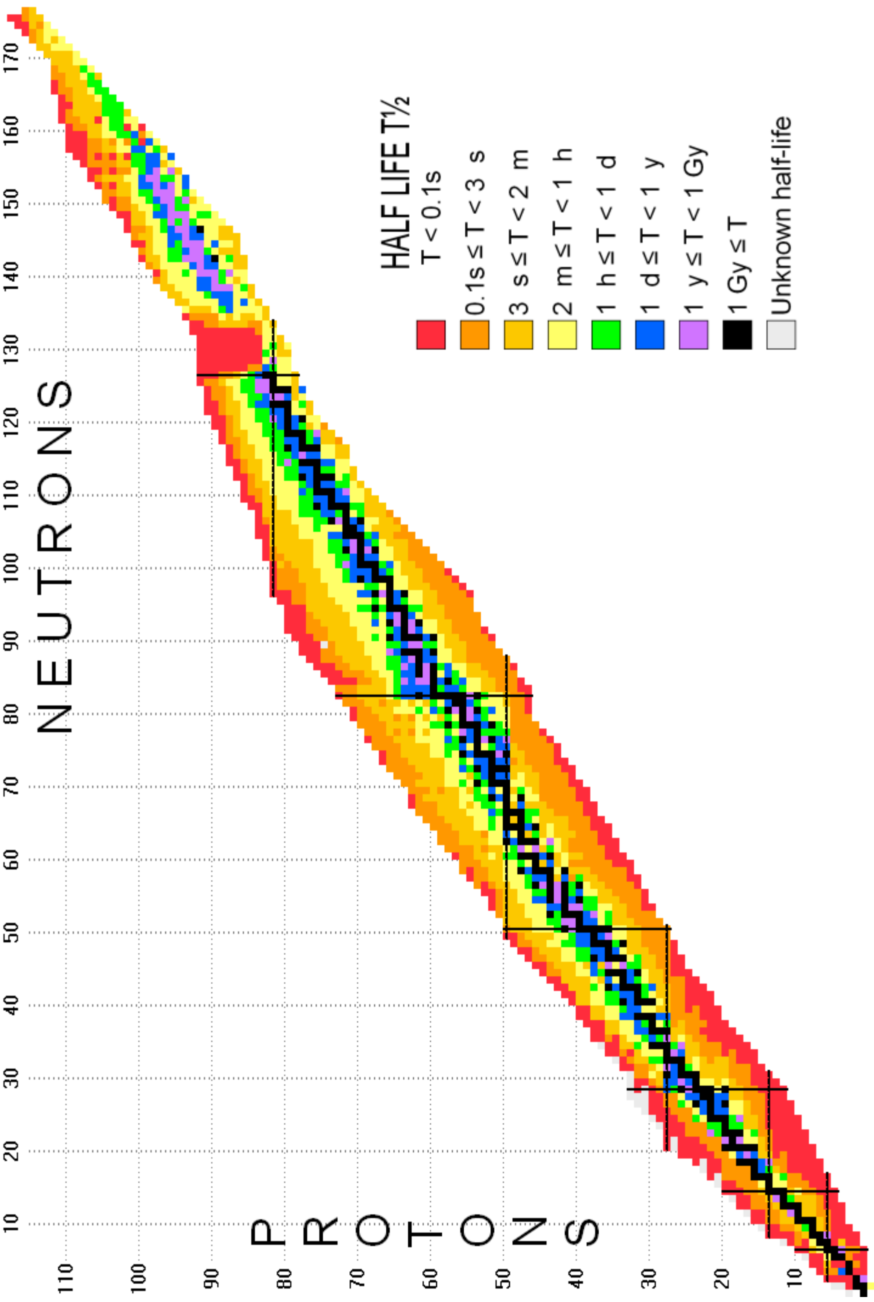

Figure 2: Chart of the nuclides for half-lives (created by NUCLEUS-AMDC).

authors will gratefully appreciate mention of such cases to improve future versions of NUBASE).

If spin and parity are not known from experiment, they can be estimated, in some cases, from systematic trends in neighboring nuclides with the same parities in N and Z. This is often true for odd-A nuclides (see Fig. 3 and Fig. 4), but also, not so rarely, for odd–odd ones, as can be seen in Fig. 5. These estimated values are also flagged with the '#' symbol. In several cases we replaced the ENSDF systematics by our own.

The review of nuclear radii and moments of Otten [1989Ot.A], in which the spins were compiled, was used to check and complete the spin values in NUBASE.

2.5. Decay modes and intensities

The most important policy, from our point of view, in coding the information for the decay modes, is in establishing a very clear distinction between a decay mode that is energetically allowed but not yet experimentally observed (represented by a question mark alone, which thus refers to the decay mode itself), and a decay mode that is actually observed but for which the intensity could not be determined (represented by '=?', the question mark referring here to the quantity after the equal sign).

As in ENSDF, no corrections have been made to normalize the primary intensities to 100%.

Besides direct updates from the literature, we also made use of partial evaluations by other authors (with proper quotation). They are mentioned below, when discussing some particular decay modes.

The β^+ decay

In the course of our work we refined some definitions and notations for the β^+ decay, in order to present more clearly the available information. We denote with β^+ the decay process that includes both electron capture, denoted ε, and the decay by positron emission, denoted e^+. One can then symbolically write: $\beta^+ = \varepsilon + e^+$. As is well known, for an available energy below 1022 keV, only electron capture ε is allowed; above that value both processes compete.

Remark: this notation is **not** the same as the one implicitly used in ENSDF, where the combination of both modes is denoted "EC+B+".

When both modes compete, the separated intensities are not always available from experiment. Most of the time, separated values in ENSDF are calculated ones. In continuation of one of our general policies, in which we retain whenever possible only experimental information, we decided not to retain ENSDF's calculated separated values (which are scarce and not always updated). Most often, it is in some very particular cases that the distinction is of importance, like in the case of rare or extremely rare processes (e.g. ^{91}Nb, ^{54}Mn, ^{119}Te^m). Then, the use of our notation is useful.

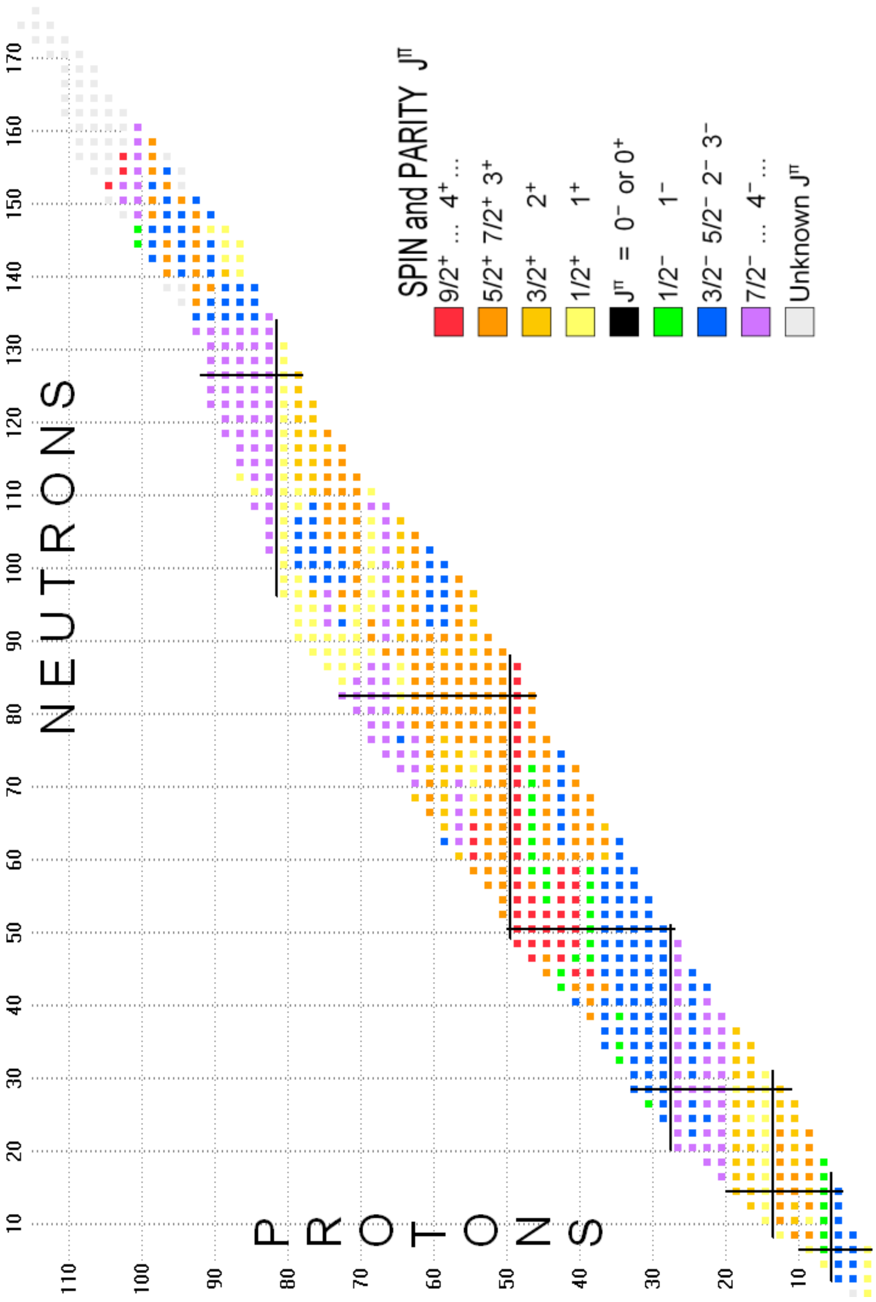

Figure 3: Chart of the nuclides for spins and parities. Shown are only the odd-*Z* even-*N* nuclides (created by NUCLEUS-AMDC).

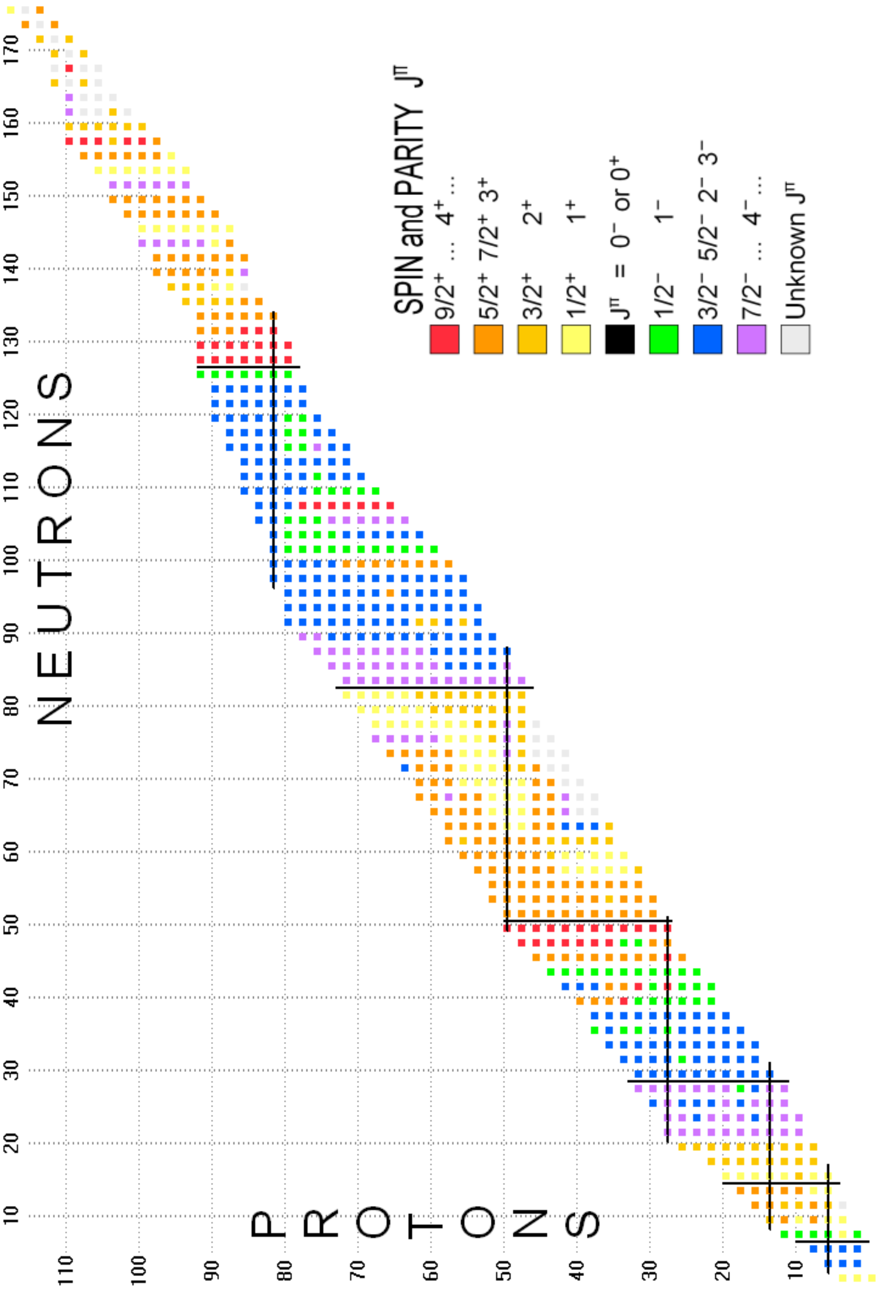

Figure 4: Chart of the nuclides for spins and parities. Shown are only the even-Z odd-N nuclides (created by NUCLEUS-AMDC).

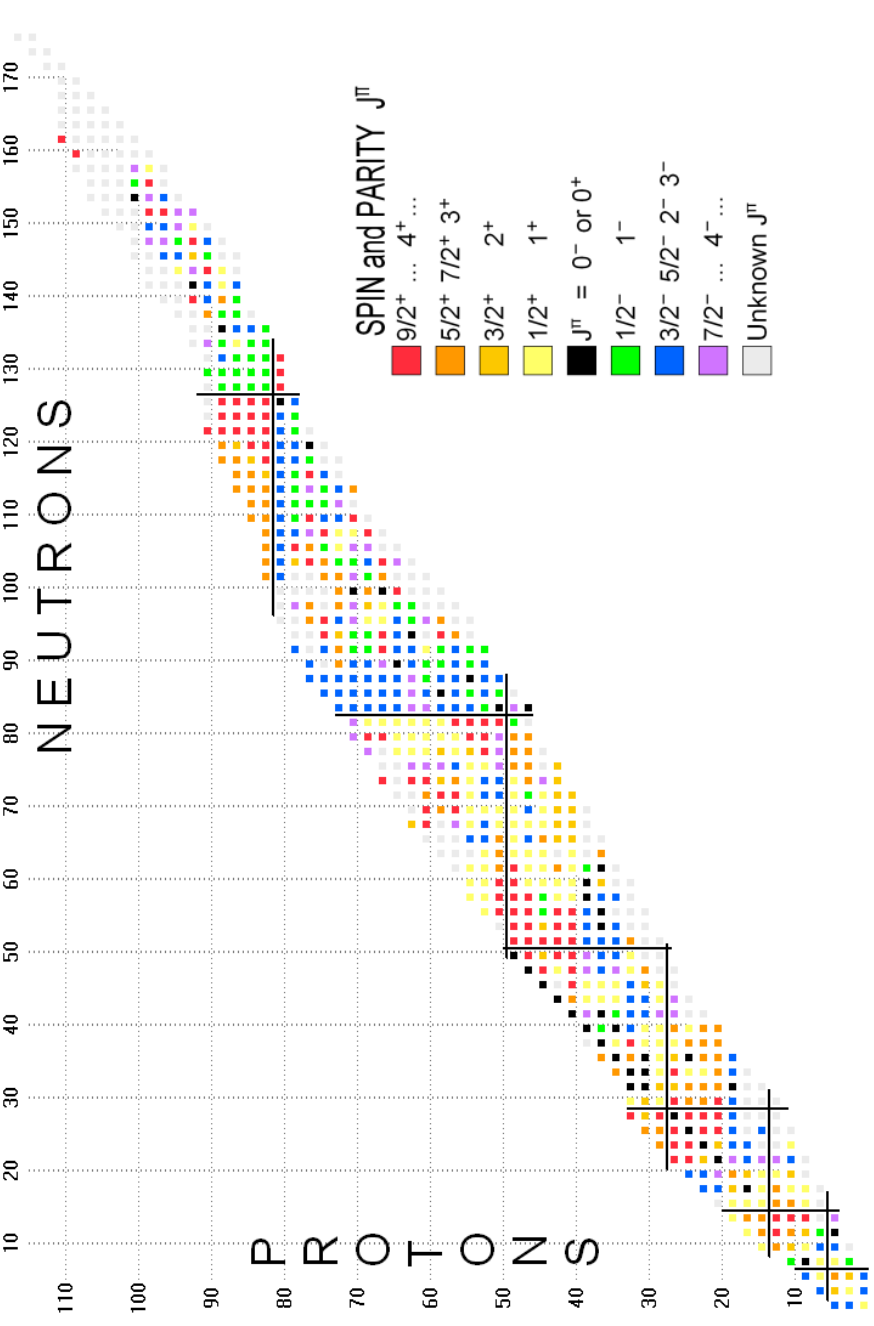

Figure 5: Chart of the nuclides for spins and parities. Shown are only the odd-*Z* odd-*N* nuclides (created by NUCLEUS-AMDC).

In the same line, we give both electron capture ε-delayed fission and the positron e^{+}-delayed fission with the same symbol β^{+}SF.

The double-β decay

In the course of our work we found that half-lives for double-β decay were not always given in a consistent way in ENSDF. For NUBASE we decided to give only half-life values or upper-limits related to the dominant process, which is in general the two-neutrino gs-gs transition (one exception may be ^{98}Mo, for which the neutrinoless decay is predicted to be faster, see [2002Tr04]). No attempt was made to convert to the same statistical confidence level (CL) upper limit results given by different authors.

The excellent recent compilation of Tretyak and Zdesenko [2002Tr04] was of great help in this part of our work.

The β-delayed decays

For delayed decays, intensities have to be considered carefully. By definition, the intensity of a decay mode is the percentage of decaying nuclei in that mode. But traditionally, the intensities of the pure β decay and of those of the delayed ones are summed to give an intensity that is assigned to the pure β decay. For example, if the (A,Z) nuclide has a decay described, according to the tradition, by 'β^{-}=100; β^{-}n=20', this means that for 100 decays of the parent (A,Z), 80 (A,Z+1) and 20 (A–1,Z+1) daughter nuclei are produced and that 100 electrons and 20 delayed-neutrons are emitted. A strict notation, following the definition above, would have been in this case 'β^{-}=80; β^{-}n=20'. However we decided to follow the tradition and use in our work the notation: 'β^{-}=100; β^{-}n=20'.

This also holds for more complex delayed emissions. A decay described by: 'β^{-}=100; β^{-}n=30; β^{-}2n=20; $\beta^{-}\alpha$=10' corresponds to the emission of 100 electrons, (30+2$\times$20=70) delayed-neutrons and 10 delayed-α particles; and in terms of residual nuclides, to 40 (A,Z+1), 30 (A–1,Z+1), 20 (A–2,Z+1) and 10 (A–4,Z–1). More generally, $P_{\rm n}$, the number of emitted neutrons per 100 decays, can be written:

$$P_{\rm n} = \sum_i i \times \beta^{-}_{i{\rm n}};$$

and similar expressions for α or proton emission. The number of residual β daughter (A,Z+1) is:

$$\beta^{-} - \sum_i \beta^{-}_{i{\rm n}} - \sum_j \beta^{-}_{j\alpha} - \ldots$$

Another special remark concerns the intensity of a particular β-delayed mode. The primary β-decay populates several excited states in the β-daughter, that will further decay by particle emission. However, in the case where the daughter's ground state also decays by the same particle emission, some authors included its decay in the value for the concerned β-delayed intensity. We decided not to do so for two reasons. Firstly, because the energies of the particles emitted from the excited states are generally much higher than that from the ground-state, implying different subsequent processes. Secondly, because the characteristic times for the decays from the excited states are related to the parent, whereas those for the decays from the daughter's ground state are due to the daughter. For example ^{9}C decays through β^+ mode with an intensity of 100% of which 12% and 11% to two excited p-emitting states in ^{9}B, and 17% to an α-emitting state. We give thus β^+p=23% and $\beta^+\alpha$=17%, from which the user of our table can derive a 60% direct feeding of the ground-state of ^{9}B. In a slightly different example, ^{8}B decays only to two excited states in ^{8}Be which in turn decay by α and γ emission, but not to the ^{8}Be ground-state. We write thus β^+=100% and $\beta^+\alpha$=100%, the difference of which leaves 0% for the feeding of the daughter's ground state.

Finally, we want to draw to the attention of the user of our table, that the percentages are, by definition, related to 100 decaying nuclei, not to the primary beta-decay fraction. An illustrative example is given by the decay of ^{228}Np, for which the delayed-fission probability is given in the original paper as 0.020(9)% [1994Kr13], but this number is relative to the ε process, the intensity of which is 59(7)%. We thus renormalized the delayed-fission intensity to 0.012(6)% of the total decay.

In collecting the delayed proton and α activities, the remarkable work of Hardy and Hagberg [1989Ha.A], in which this physics was reviewed and discussed, was an appreciable help in our work. The review of Honkanen, Äystö and Eskola [6] on delayed-protons has also been verified.

Similarly, the review of delayed neutron emission by Hansen and Jonson [1989Ha.B] was carefully examined and used in our table, as well as the evaluation of Rudstam, Aleklett and Sihver [1993Ru01].

2.6. Isotopic abundances

Isotopic abundances are taken from the compilation of K.J.R. Rosman and P.D.P. Taylor [1998Ro45] and are listed in the decay field with the symbol IS. They are displayed as given in [1998Ro45], i.e. we did not even apply our rounding policy.

2.7. References

The year of the archival file is indicated for the nuclides evaluated in ENSDF; otherwise, this entry is left blank.

References for all of the experimental updates are given by the NSR key number [3], and listed at the end of this issue (p. 579). They are followed by one, two or three one-letter codes which specify the added or modified physical quantities (see the

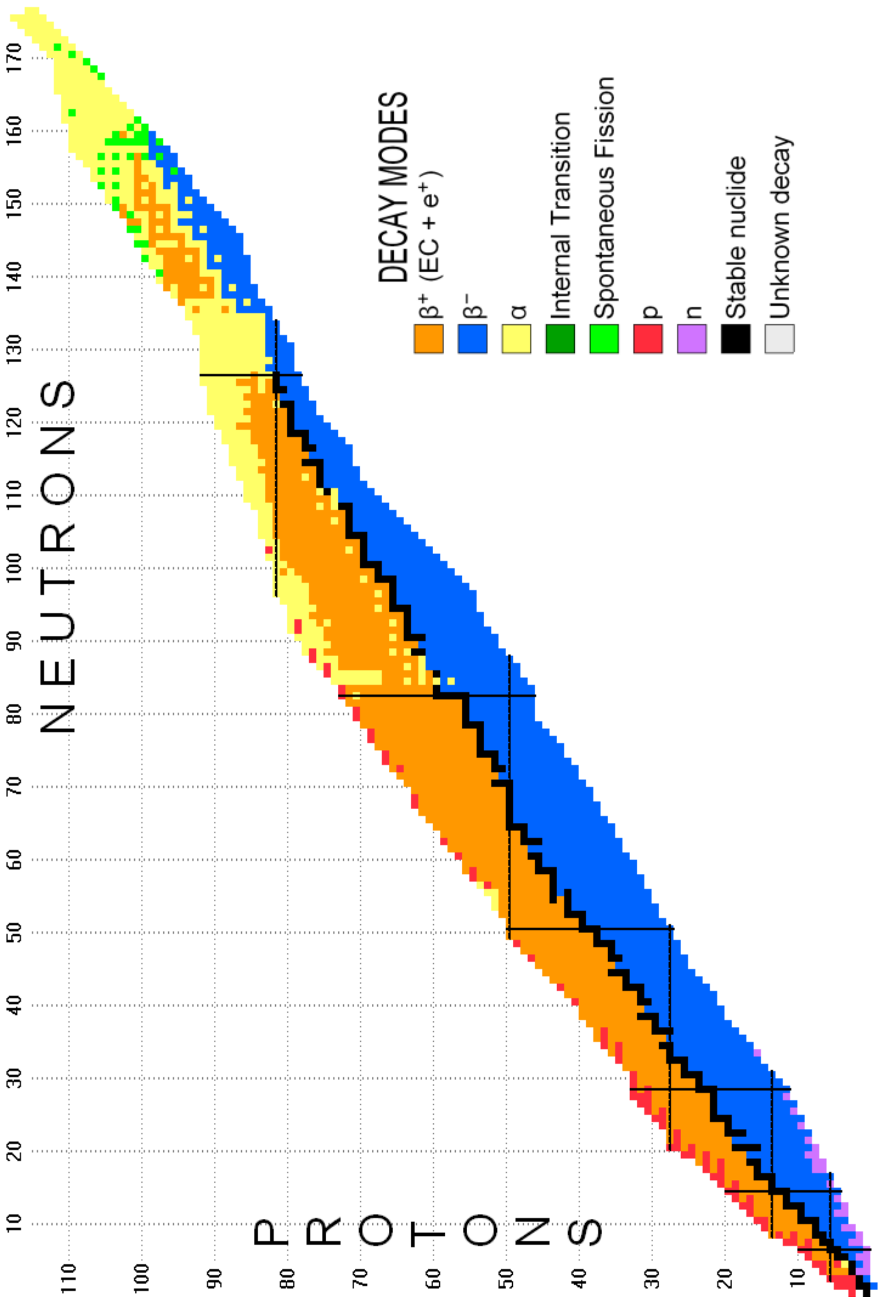

Figure 6: Chart of the nuclides for decay modes (created by NUCLEUS-AMDC).

Explanation of Table). In cases where more than one reference is needed to describe the updates, they are given in a remark. No reference is given for systematic values. The ABBW reference key is used in cases where it may not appear unambiguously that re-interpretations of the data were made by the present authors.

3. Updating procedure

NUBASE is updated via two routes: from ENSDF after each new *A*-chain evaluation (or from the bi-annual releases), and directly from the literature.

ENSDF files are retrieved from NNDC using the on-line service [1] and transferred through the Internet. Two of the present authors [7] developed programs to successively:
• check that each *Z* in the *A*-chain has an 'adopted levels' data set; if not, a corresponding data set is generated from the 'decay' or 'reaction' data set,
• extract the 'adopted levels' data sets from ENSDF,
• extract from these data sets the required physical quantities, and convert them into a format similar to the NUBASE format.

The processed data are used to update manually the previous version of NUBASE. This step is done separately by the four authors and cross-checked until full agreement is reached.

The ENSDF is updated generally by *A*-chains, and, more recently, also by individual nuclides. Its contents however is very large, since it encompasses all the complex nuclear structure and decay properties. This is a huge effort, and it is no wonder that some older data (including annual reports, conference proceedings, and theses) are missing, and that some recent data have not yet been included. Where we notice such missing data, they are analyzed and evaluated, as above, independently by the four authors and the proposed updatings are compared. Most often these new data are included in the next ENSDF evaluation and the corresponding references can be removed from the NUBASE database.

4. Distribution and displays of NUBASE

Full content of the present evaluation is accessible on-line at the web site of the Atomic Mass Data Center (AMDC) [8] through the *World Wide Web*. An electronic ASCII file for the NUBASE table, for use with computer programs, is also distributed by the AMDC. This file will **not** be updated, to allow stable reference data for calculations. Any work using that file should make reference to the present paper and not to the electronic file.

The contents of NUBASE can be displayed by a Java program JVNUBASE [9] through the *World Wide Web* and also with a PC-program called "NUCLEUS" [10]. Both can be accessed or downloaded from the AMDC. They will be updated regularly to allow the user to check for the latest available information in NUBASE.

5. Conclusions

A 'horizontal' evaluated database has been developed which contains most of the main properties of the nuclides in their ground and isomeric states. These data originate from a critical compilation of two evaluated datasets: the ENSDF, updated and completed from the literature, and the AME. The guidelines in setting up this database were to cover as completely as possible all the experimental data, and to provide proper reference for those used in NUBASE and not already included in ENSDF; this traceability allows any user to check the recommended data and, if necessary, undertake a re-evaluation.

As a result of this 'horizontal' work, a greater homogeneity in data handling and presentation has been obtained for all of the nuclides. Furthermore, isomeric assignments and excitation energies have been reconsidered on a firmer basis and their data improved.

It is expected to follow up this second version of NUBASE with improved treatments. Among them, we plan to complete the extension due to the new definition of isomer to states with half-lives between 100 ns and 1 millisecond that are available at the large-scale facilities. Another foreseeable implementation would be to provide the main α, γ, conversion and X-ray lines accompanying the decays. NUBASE could also be extended to other nuclear properties: energies of the first 2^+ states in even-even nuclides, radii, moments ... An interesting feature that is already implemented, but not yet checked sufficiently to be included here, is to give for each nuclide, in ground or isomeric-state, the year of its discovery.

6. Acknowledgements

We wish to thank our many colleagues who answered our questions about their experiments and those who sent us preprints of their papers. Continuous interest, discussions, suggestions and help in the preparation of the present publication by C. Thibault were highly appreciated. We appreciate the help provided by J.K. Tuli in solving some of the puzzles we encountered. Special thanks are due to S. Audi for the preparation of the color figures from the NUCLEUS program, and to C. Gaulard and D. Lunney for careful reading of the manuscript. A.H.W. expresses his gratitude to the NIKHEF-K laboratory and especially to Mr. K. Huyser for his continual help, and J.B. to the ISN-Grenoble and DRFMC-Grenoble laboratories for permission to use their facilities.

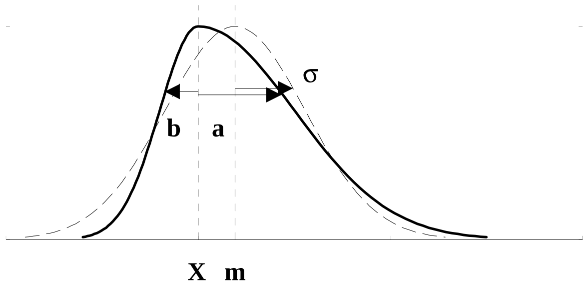

Figure 7: Simulated asymmetric probability density function (heavy solid line) and the equivalent symmetric one (dashed line).

Appendix A. Symmetrization of asymmetric uncertainties

Experimental data are sometimes given with asymmetric uncertainties, X^{+a}_{-b}. If these data are to be used with other ones in some applications, their uncertainties may need to be symmetrized. A simple method (Method 1), used earlier, consisted in taking the central value to be the mid-value between the upper and lower 1 σ-equivalent limits $X+(a-b)/2$, and define the uncertainty to be the average of the two uncertainties $(a+b)/2$.

An alternative method (Method 2) is to consider the random variable x associated with the measured quantity. For this random variable, we assume the probability density function to be an asymmetric normal distribution having a modal (most probable) value of $x = X$, a standard deviation b for $x < X$, and a standard deviation a for $x > X$ (Fig. 7). Then the average value of this distribution is

$$\langle x \rangle = X + \sqrt{2/\pi}\,(a-b),$$

with variance

$$\sigma^2 = (1-2/\pi)\,(a-b)^2 + ab. \tag{1}$$

The median value m which divides the distribution into two equal areas is given, for $a > b$, by

$$\mathrm{erf}\left(\frac{m-X}{\sqrt{2}a}\right) = \frac{a-b}{2a}, \tag{2}$$

and by a similar expression for $b > a$.

We define the equivalent symmetric normal distribution we are looking for as a distribution having a mean value equal to the median value m of the previous distribution with same variance σ.

Table A. Examples of treatment of asymmetric uncertainties for half-lives. Method 1 is the classical method, used previously, as in the AME'95. Method 2 is the one developed in this Appendix and used for half-lives and intensities of the decay modes.

Nuclide	Original $T_{1/2}$		Method 1	Method 2
^{76}Ni	240+550–190	ms	420 ± 370	470 ± 390
^{222}U	1.0+1.0–0.4	μs	1.3 ± 0.7	1.4 ± 0.7
^{264}Hs	327+448–120	μs	490 ± 280	540 ± 300
^{266}Mt	1.01+0.47–0.24	ms	1.1 ± 0.4	1.2 ± 0.4

If the shift $m-X$ of the central value is small compared to a or b, expression (2) can be written [11]:

$$m-X \simeq \sqrt{\pi/8}\,(a-b) \simeq 0.6267\,(a-b).$$

In order to allow for a small non-linearity that appears for higher values of $m-X$, we adopt for Method 2 the relation

$$m-X = 0.64\,(a-b).$$

Table A illustrates the results from both methods. In NUBASE, Method 2 is used for the symmetrization of asymmetric half-lives and of asymmetric decay intensities.

References

*References quoted in the text as [1993Po.A] or [2002Tr04] (*NSR *style) are listed under "References used in the* AME2003 *and the* NUBASE2003 *evaluations", p. 579.*

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[11] R.D. Evans, The Atomic Nucleus (McGraw-Hill, New York, 1955) p. 766.

Table I. Table of nuclear and decay properties

EXPLANATION OF TABLE

Data are presented in groups ordered according to increasing mass number A.

Nuclide	Nuclidic name: mass number $A = N + Z$ and element symbol (for $Z > 109$ see Section 2). Element indications with suffix '*m*', '*n*', '*p*' or '*q*' indicate assignments to excited isomeric states (defined, see text, as upper states with half-lives larger than 100 ns). Suffixes '*p*' and '*q*' indicate also non-isomeric levels, of use in the AME2003. Suffix '*r*' indicates a state from a proton resonance occurring in (p,γ) reactions (e.g. ^{28}Si^r). Suffix '*x*' applies to mixtures of levels (with relative ratio *R*, given in the 'Half-life'column), e.g. occurring in spallation reactions (indicated 'spmix' in the 'J^π' column) or fission ('fsmix').
Mass excess	Mass excess [M(in u)$-A$], in keV, and its one standard deviation uncertainty as given in the 'Atomic Mass Evaluation' (AME2003, second part of this volume). Rounding policy: in cases where the furthest-left significant digit in the error is larger than 3, values and errors are rounded off, but not to more than tens of keV. (Examples: $2345.67 \pm 2.78 \rightarrow 2345.7 \pm 2.8, 2345.67 \pm 4.68 \rightarrow 2346 \pm 5$, but $2346.7 \pm 468.2 \rightarrow 2350 \pm 470$). # in place of decimal point: value and uncertainty derived not from purely experimental data, but at least partly from systematic trends (cf. AME2003).
Excitation energy	For excited isomers only: energy difference, in keV, between levels adopted as higher level isomer and ground state isomer, and its one standard deviation uncertainty, as given in AME2003 when derived from the AME, otherwise as given by ENSDF. The rounding policy is the same as for the mass excess (see above). # in place of decimal point: value and uncertainty derived from systematic trends. The excitation energy is followed by its origin code when derived from a method other than γ-ray spectrometry: MD Mass doublet RQ Reaction energy difference AD α energy difference BD β energy difference p proton decay XL L X-rays Nm estimated value derived with help of Nilsson model When the existence of an isomer is questionable the following codes are used: EU existence of isomer is under discussion (e.g. ^{141}Tb^m). If existence is strongly doubted, no excitation energy and no mass are given. They are replaced by the mention "non-existent" (e.g. ^{138}Pm^n). RN isomer is proved not to exist (e.g. ^{184}Lu^m). Excitation energy and mass are replaced by the mention "non-existent". Remark: codes EU and RN are also used when the discovery of a nuclide (e.g. ^{260}Fm) is questioned. In this case however we always give an estimate, derived from systematic trends, for the ground state mass. Isomeric assignment: $*$ In case the uncertainty σ on the excitation energy E is larger than half that energy ($\sigma > E/2$), these quantities are followed by an asterix (e.g. ^{130}In and ^{130}In^m). & In case the ordering of the ground- and isomeric-states are reversed compared to ENSDF, an ampersand sign is added (e.g. ^{90}Tc and ^{90}Tc^m).

Half-life	s = seconds; m = minutes; h = hours; d = days; y = years; 1 y = 31 556 926 s or 365.2422 d adopted values for NUBASE (see text) STABLE = stable nuclide or nuclide for which no finite value for half-life has been found. # value estimated from systematic trends in neighboring nuclides with the same Z and N parities.

subunits:

ms:	10^{-3}	s	millisecond	ky:	10^{3}	y	kiloyear
μs:	10^{-6}	s	microsecond	My:	10^{6}	y	megayear
ns:	10^{-9}	s	nanosecond	Gy:	10^{9}	y	gigayear
ps:	10^{-12}	s	picosecond	Ty:	10^{12}	y	terayear
fs:	10^{-15}	s	femtosecond	Py:	10^{15}	y	petayear
as:	10^{-18}	s	attosecond	Ey:	10^{18}	y	exayear
zs:	10^{-21}	s	zeptosecond	Zy:	10^{21}	y	zettayear
ys:	10^{-24}	s	yoctosecond	Yy:	10^{24}	y	yottayear

For isomeric mixtures: R is the production ratio of excited isomeric state to ground-state.

J^{π} Spin and parity:

()	uncertain spin and/or parity.
#	values estimated from systematic trends in neighboring nuclides with the same Z and N parities.
high	high spin.
low	low spin.
am	same J^{π} as α-decay parent;

For isomeric mixtures: mix (spmix and fsmix if coming from spallation and fission respectively).

Ens Year of the archival file of the ENSDF
(in order to reduce the width of the Table, the two digits for the centuries are omitted).

Reference Reference keys:
(in order to reduce the width of the Table, the two digits for the centuries are omitted; at the end of this volume however, the full reference key-number is given: 1992Pa05 and not 92Pa05)

92Pa05	Updates to ENSDF derived from regular journal. These keys are taken from Nuclear Data Sheets. Where not yet available, the style 03Ya.1 is provisionally adopted.
95Am.A	Updates to ENSDF derived from abstract, preprint, private communication, conference, thesis or annual report.
ABBW	Re-interpretation by the present authors.

The reference key-numbers are followed by one, two or three letter codes which specifies the added or modified physical quantities:

T	for half-life
J	for spin and/or parity
E	for the isomer excitation energy
D	for decay mode and/or intensity
I	for identification

Decay modes and intensities	Decay modes followed by their intensities (in %), and their one standard deviation uncertainties. The special notation 1.8e–12 stands for 1.8×10^{-12}. The uncertainties are given - only in this field - in the ENSDF-style: α=25.9 23 stands for α=25.9 ± 2.3 % The ordering is according to decreasing intensities.

α	α emission	
p 2p	proton emission	2-proton emission
n 2n	neutron emission	2-neutron emission
ε	electron capture	
e^+	positron emission	
β^+	β^+ decay	$(\beta^+ = \varepsilon + e^+)$
β^-	β^- decay	
$2\beta^-$	double β^- decay	
$2\beta^+$	double β^+ decay	
β^-n	β^- delayed neutron emission	
β^-2n	β^- delayed 2-neutron emission	
β^+p	β^+ delayed proton emission	
β^+2p	β^+ delayed 2-proton emission	
$\beta^-\alpha$	β^- delayed α emission	
$\beta^+\alpha$	β^+ delayed α emission	
β^-d	β^- delayed deuteron emission	
IT	internal transition	
SF	spontaneous fission	
β^+SF	β^+ delayed fission	
β^-SF	β^- delayed fission	
^{24}Ne	heavy cluster emission	
...	list is continued in a remark, at the end of the *A*-group	

For long-lived nuclides:

IS	Isotopic abundance

*	A remark on the corresponding nuclide is given below the block of data corresponding to the same *A*.

Remarks. For nuclides indicated with an asterix at the end of the line, remarks have been added. They are collected in groups at the end of each block of data corresponding to the same *A*. They start with a code letter, like the ones following the reference key-number, as given above, indicating to which quantity the remark applies. They give:

i) Continuation for the list of decays. In this case, the remark starts with three dots.
ii) Information explaining how a value has been derived.
iii) Reasons for changing a value or its uncertainty as given by the authors or for rejecting it.
iv) Complementary references for updated data.
v) Separate values entering an adopted average.

Nuclide	Mass excess (keV)		Excitation energy(keV)	Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{1}n	8071.3171	0.0005		613.9	s	0.6	$1/2^+$	00	02PaDG	T	β^-=100	
^{1}H	7288.9705	0.0001		STABLE			$1/2^+$	00	98Ro45	D	IS=99.9885 70	*
*^{1}H	D : all isotopic abundances in NUBASE are from 98Ro45											**
^{2}H	13135.7216	0.0003		STABLE			1^+	99			IS=0.0115 70	
^{3}H	14949.8060	0.0023		12.32	y	0.02	$1/2^+$	00			β^-=100	
^{3}He	14931.2148	0.0024		STABLE			$1/2^+$	98			IS=0.000137 3	
^{3}Li	28670#	2000#	RN	p-unstable				98			p ?	
^{4}H	25900	100		139	ys	10	2^-	98	03Me11	T	n=100	*
^{4}He	2424.9156	0.0001		STABLE			0^+	98			IS=99.999863 3	
^{4}Li	25320	210		91	ys	9	2^-	98	65Ce02	T	p=100	
*^{4}H	T : width=3.28(0.23) MeV; also 91Go19=4.7(1.0) outweighed, not used											**
^{5}H	32890	100		$>$ 910	ys		$(1/2^+)$	02	03Go11	T	2n=100	*
^{5}He	11390	50		700	ys	30	$3/2^-$	02			n=100	
^{5}Li	11680	50		370	ys	30	$3/2^-$	02			p=100	
^{5}Be	38000#	4000#					$1/2^+$#	02			p ?	
*^{5}H	T : from width $<$ 0.5 MeV; at variance with 01Ko52=280(50) ys, width=1.9(0.4)											**
*^{5}H	T : (same authors) but with instrumental resolution=1.3 MeV											**
*^{5}H	T : others 91Go19=66(25) ys 95Al31=110 ys probably for higher state											**
*^{5}H	J : from angular distribution consistent with $l=0$											**
^{6}H	41860	260		290	ys	70	2^-#	02			n ?; 3n ?	
^{6}He	17595.1	0.8		806.7	ms	1.5	0^+	02	90Ri01	D	β^-=100; β^-d=0.00028 5	
^{6}Li	14086.793	0.015		STABLE			1^+	02			IS=7.59 4	
^{6}Be	18375	5		5.0	zs	0.3	0^+	02			2p=100	
^{6}B	43600#	700#		p-unstable#			2^-#				2p ?	
^{7}H	49140#	1010#		23	ys	6	$1/2^+$#		03Ko11	T	2n ?	*
^{7}He	26101	17		2.9	zs	0.5	$(3/2)^-$	03	02Me07	T	n=100	*
^{7}Li	14908.14	0.08		STABLE			$3/2^-$	03			IS=92.41 4	
^{7}Be	15770.03	0.11		53.22	d	0.06	$3/2^-$	03			ε=100	
^{7}B	27870	70		350	ys	50	$(3/2^-)$	03			p=100	
*^{7}H	T : from estimated width 20(5) MeV in Fig. 5											**
*^{7}He	T : from 159(28) keV, average 02Me07=150(80) 69St02=160(30)											**
^{8}He	31598	7		119.0	ms	1.5	0^+	99	88Aj01	D	β^-=100; β^-n=16 1; β^-t=0.9 1	*
^{8}Li	20946.84	0.09		840.3	ms	0.9	2^+	99	90Sa16	T	β^-=100; $\beta^-\alpha$=100	*
^{8}Be	4941.67	0.04		67	as	17	0^+	99			α=100	
^{8}B	22921.5	1.0		770	ms	3	2^+	99	88Aj01	D	β^+=100; $\beta^+\alpha$=100	*
^{8}C	35094	23		2.0	zs	0.4	0^+	99			2p=100	
*^{8}He	D : β^-n intensity is from 88Aj01; β^-t intensity from 86Bo41											**
*^{8}Li	D : β^- decay to first 2^+ state in ^{8}Be, which decays 100% in 2 α											**
*^{8}B	D : β^+ to 2 excited states in ^{8}Be, then α and γ, but not to ^{8}Be ground-state											**
^{9}He	40939	29		7	zs	4	$1/2^{(-\#)}$	99	99Bo26	T	n=100	*
^{9}Li	24954.3	1.9		178.3	ms	0.4	$3/2^-$	99	95Re.A	D	β^-=100; β^-n=50.8 2	*
^{9}Be	11347.6	0.4		STABLE			$3/2^-$	99			IS=100.	
^{9}B	12415.7	1.0		800	zs	300	$3/2^-$	99			p=100	
^{9}C	28910.5	2.1		126.5	ms	0.9	$(3/2^-)$	99	88Aj01	D	β^+=100; β^+p=23; $\beta^+\alpha$=17	*
*^{9}He	T : derived from width 100(60) keV J : from 01Ch31											**
*^{9}Li	D : also 92Te03 β^-n=51(1)% 81La11=49(5) outweighed, not used											**
*^{9}C	D : β^+=12% and 11% to 2 excited p-emitting states in ^{9}B, and 17% to α emitter											**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{10}He	48810	70				2.7	zs	1.8	0^+	99	94Os04	T	2n=100	*
^{10}Li	33051	15				2.0	zs	0.5	$(1^-,2^-)$	99	94Yo01	TJ	n=100	
^{10}Li^m	33250	40	200	40	RQ	3.7	zs	1.5	1^+		97Zi04	T	IT=100	*
^{10}Li^n	33530	40	480	40	RQ	1.35	zs	0.24	2^+		94Yo01	T	IT=100	*
^{10}Be	12606.7	0.4				1.51	My	0.06	0^+	99			β^-=100	
^{10}B	12050.7	0.4				STABLE			3^+	99			IS=19.9 7	
^{10}C	15698.7	0.4				19.290	s	0.012	0^+	99	90Ba02	T	β^+=100	
^{10}N	38800	400				200	ys	140	(2^-)	99	02Le16	TJ	p ?	
*^{10}He	D : most probably 2 neutron emitter from S_{2n}=–1070(70) keV													**
*^{10}Li^m	T : average 97Zi04=120(+100–50) 94Yo01=100(70) keV													**
*^{10}Li^n	T : average 94Yo01=358(23) 93Bo03=150(70) keV, Birge ratio B=2.8													**
^{11}Li	40797	19				8.75	ms	0.14	$3/2^-$	00	97Mo35	T	β^-=100; β^-n=84.9 8; . . .	*
^{11}Be	20174	6				13.81	s	0.08	$1/2^+$	00	81Al03	D	β^-=100; $\beta^-\alpha$=2.9 4	
^{11}B	8667.9	0.4				STABLE			$3/2^-$	00			IS=80.1 7	
^{11}C	10650.3	1.0				20.39	m	0.02	$3/2^-$	00			β^+=100	
^{11}N	24300	50				590	ys	210	$1/2^+$	00	03Gu06	T	p=100	*
^{11}N^m	25040	80	740	60		690	ys	80	$1/2^-$		96Ax01	ETJ	p=100	
*^{11}Li	D : . . . ; β^-2n=4.1 4; β^-3n=1.9 2; β^-nα=1.00 6; β^-t=0.014 3; β^-d=0.013 5													**
*^{11}Li	D : β^-n, β^-2n and β^-3n intensities are from 89Ha.B's evaluation;													**
*^{11}Li	D : β^-nα intensity is from 84La27; β^-d intensity from 96Mu19;													**
*^{11}Li	D : β^-t: average 84La27=0.010(4)% 96Mu19=0.020(5)%													**
*^{11}Li	T : average 97Mo35=8.99(0.10) 96Mu19=8.2(0.2) 95Re.A=8.4(0.2)													**
*^{11}Li	T : 81Bj01=8.83(0.12) and 74Ro31=8.5(0.2)													**
*^{11}N	T : unweighed average 03Gu06=0.24(0.24) 00Ma62=1.44(0.2) MeV 00Ol01=0.4(0.1)													**
*^{11}N	T : and 96Ax01=0.99(0.20) MeV (Birge ratio B=3.03)													**
^{12}Li	50100#	1000#				< 10	ns			00	74Bo05	I	n ?	
^{12}Be	25077	15				21.50	ms	0.04	0^+	00	01Be53	T	β^-=100; β^-n=0.50 3	*
^{12}B	13368.9	1.4				20.20	ms	0.02	1^+	00	66Sc23	D	β^-=100; $\beta^-\alpha$=1.6 3	
^{12}C	0.0	0.0				STABLE			0^+	00			IS=98.93 8	
^{12}N	17338.1	1.0				11.000	ms	0.016	1^+	00	66Sc23	D	β^+=100; $\beta^+\alpha$=3.5 5	
^{12}O	32048	18				580	ys	30	0^+	00	95Kr03	T	2p=60 30; β^+ ?	
*^{12}Be	D : from 99Be53; also 95Re.A=0.52 9% outweighed, not used													**
^{13}Be	33250	70				0.5	ns	0.1	$(1/2^+)$		01Th01	TJ	n ?	
^{13}Be^p	33950	90	700	120	RQ	2.7	zs	1.8	$(1/2^-)$	00				
^{13}Be^q	35160	50	1910	90	RQ				$(5/2^+)$					
^{13}B	16562.2	1.1				17.33	ms	0.17	$3/2^-$	00			β^-=100; β^-n=0.28 4	
^{13}C	3125.0113	0.0009				STABLE			$1/2^-$	01			IS=1.07 8	
^{13}N	5345.48	0.27				9.965	m	0.004	$1/2^-$	00			β^+=100	
^{13}O	23112	10				8.58	ms	0.05	$(3/2^-)$	00	70Es03	D	β^+=100; β^+p=10.9 20	
^{14}Be	39950	130				4.35	ms	0.17	0^+	01	02Je11	D	β^-=100; β^-n=98 2; . . .	*
^{14}Be^p	41470	60	1520	150					(2^+)		95Bo10			
^{14}B	23664	21				12.5	ms	0.5	2^-	01	95Re.A	D	β^-=100; β^-n=6.04 23	
^{14}C	3019.893	0.004				5.70	ky	0.03	0^+	01			β^-=100	
^{14}N	2863.4170	0.0006				STABLE			1^+	01			IS=99.632 7	
^{14}O	8007.36	0.11				70.598	s	0.018	0^+	01	01Ga59	T	β^+=100	*
^{14}F	32660#	400#							2^-#				p ?	
*^{14}Be	D : . . . ; β^-2n=0.8 08; β^-3n=0.2 2; β^-t=0.02 1; $\beta^-\alpha$<0.004													**
*^{14}Be	D : supersedes 99Be53, same group													**
*^{14}O	T : average 01Ga59=70.560(0.049) 78Wi04=70.613(0.025) 73Cl12=70.590(0.030)													**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{15}Be	49800#	500#			< 200	ns				03Ba47	I	n ?	
^{15}B	28972	22			9.87	ms	0.07	$3/2^-$	93	95Re.A	TD	β^-=100; β^-n=93.6 12; β^-2n=0.4 2	*
^{15}C	9873.1	0.8			2.449	s	0.005	$1/2^+$	94			β^-=100	
^{15}N	101.4380	0.0007			STABLE			$1/2^-$	94			IS=0.368 7	
^{15}O	2855.6	0.5			122.24	s	0.16	$1/2^-$	94			β^+=100	
^{15}F	16780	130			410	ys	60	$(1/2^+)$	93	01Ze.A	T	p=100	*
*^{15}B	D : β^-2n intensity is from 89Re.A				J : given in 91Aj01								**
*^{15}B	T : four other outweighed results, see ENSDF'93, ranging 10.1 - 10.8 ms												**
*^{15}F	T : average 01Ze.A=1.23(0.22)MeV 78Be16=1.2(0.3) 78Ke06=0.8(0.3)												**
^{16}Be	57680#	500#			< 200	ns		0^+		03Ba47	I	2n ?	*
^{16}B	37080	60			< 190	ps		0^-	99			n ?	
^{16}C	13694	4			747	ms	8	0^+	99	89Re.A	D	β^-=100; β^-n=97.9 23	
^{16}N	5683.7	2.6			7.13	s	0.02	2^-	99	74Ne10	D	β^-=100; $\beta^-\alpha$=0.00100 7	
^{16}O	−4737.0014	0.0001			STABLE			0^+	99			IS=99.757 16	
^{16}F	10680	8			11	zs	6	0^-	99			p=100	
^{16}Ne	23996	20			9	zs		0^+	99			2p=100	
*^{16}Be	I : 100 events expected, none observed												**
^{17}B	43770	170			5.08	ms	0.05	$(3/2^-)$	99	88Du09	D	β^-=100; β^-n=63 1; ...	*
^{17}C	21039	17			193	ms	5	$(3/2^+)$	99	01Ma08	J	β^-=100; β^-n=28.4 13	*
^{17}N	7871	15			4.173	s	0.004	$1/2^-$	99	94Do08	D	β^-=100; β^-n=95 1; ...	*
^{17}O	−808.81	0.11			STABLE			$5/2^+$	99			IS=0.038 1	
^{17}F	1951.70	0.25			64.49	s	0.16	$5/2^+$	99			β^+=100	
^{17}Ne	16461	27			109.2	ms	0.6	$1/2^-$	99	88Bo39	D	β^+=100; β^+p=96.0 9; $\beta^+\alpha$=2.7 9	
*^{17}B	D : ... ; β^-2n=11 7; β^-3n=3.5 7; β^-4n=0.4 3												**
*^{17}C	T : average 95Sc03=193(6) 95Re.A=188(10) 86Cu01=202(17)												**
*^{17}C	D : β^-n intensity is from 95Re.A												**
*^{17}N	D : ... ; $\beta^-\alpha$=0.0025 4												**
^{18}B	52320#	800#			< 26	ns		4^-#		93Po.A	I	n ?	
^{18}C	24930	30			92	ms	2	0^+	96			β^-=100; β^-n=31.5 15	
^{18}N	13114	19			622	ms	9	1^-	96	95Re.A	D	β^-=100; β^-n=10.9 9; ...	*
^{18}O	−781.5	0.6			STABLE			0^+	96			IS=0.205 14	
^{18}F	873.7	0.5			109.771	m	0.020	1^+	96	02Un02	T	β^+=100	
^{18}F^m	1995.1	0.5	1121.36	0.15	234	ns		5^+					
^{18}Ne	5317.17	0.28			1.672	s	0.008	0^+	96			β^+=100	
^{18}Na	24190	50			1.3	zs	0.4	1^-#		01Ze.A	TD	p=?; β^+ ?	
*^{18}N	D : ... ; $\beta^-\alpha$=12.2 6												**
*^{18}N	D : β^-n intensity is from 95Re.A; $\beta^-\alpha$ intensity from 89Zh04												**
*^{18}N	T : average 99Og03=620(14) 82Ol01=624(12)												**
^{19}B	59360#	400#			2.92	ms	0.13	$3/2^-$#	96	03Yo02	T	β^-=100; β^-n≈75; ...	*
^{19}C	32420	100			46.2	ms	2.3	$(1/2^+)$	96	88Du09	TD	β^-=100; β^-n=47 3; ...	*
^{19}N	15862	16			271	ms	8	$(1/2)^-$	96			β^-=100; β^-n=54.6 14	*
^{19}O	3334.9	2.8			26.464	s	0.009	$5/2^+$	96	94It.A	T	β^-=100	
^{19}F	−1487.39	0.07			STABLE			$1/2^+$	96			IS=100.	
^{19}Ne	1751.44	0.29			17.296	s	0.005	$1/2^+$	96	94Ko.A	T	β^+=100	
^{19}Na	12927	12			< 40	ns		$5/2^+$#	96	93Po.A	I	p=100	*
^{19}Mg	33040	250						$1/2^-$#	96			2p ?	
*^{19}B	D : ... ; β^-2n≈25												**
*^{19}B	T : others: 99Re16=4.5(1.5) 98Yo06=3.3(0.2 statistics + 2.0 systematics estimated by NUBASE)												**
*^{19}B	D : deduced from $P_n = \beta^-$n + 2×β^-2n + ... =125(32)% in 98Yo06 and assuming												**
*^{19}B	D : β^-n + β^-2n=100%												**
*^{19}C	D : ... ; β^-2n=7 3												**
*^{19}C	T : average 88Du09=49(4) 95Re.A=44(4) 95Oz02=45.5(4.0)												**
*^{19}C	J : from 01Ma08, 99Na27 and 95Ba28												**
*^{19}N	J : 95Oz02=$(1/2, 3/2, 5/2)^-$ 89Ca25=$(1/2^-)$												**
*^{19}Na	D : most probably proton emitter from S_p=–333(12) keV												**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{20}C	37560	240			16	ms	3	0^+	98	90Mu06	T	β^-=100; β^-n=72 14	∗
^{20}N	21770	60			130	ms	7		98	95Re.A	TD	β^-=100; β^-n=57.0 25	
^{20}O	3797.5	1.1			13.51	s	0.05	0^+	98			β^-=100	
^{20}F	−17.40	0.08			11.163	s	0.008	2^+	98	98Ti06	T	β^-=100	
^{20}Ne	−7041.9313	0.0018			STABLE			0^+	98			IS=90.48 3	
^{20}Na	6848	7			447.9	ms	2.3	2^+	98	89Cl02	D	β^+=100; $\beta^+\alpha$=25.0 4	
^{20}Mg	17570	27			90	ms	6	0^+	98	95Pi03	TD	β^+=100; β^+p=30.4 16	∗

∗^{20}C T : average 90Mu06=14(+6–5) 95Re.A 16.7(3.5) ∗∗
∗^{20}Mg T : average 95Pi03=95(3) 92Go10=82(4), with Birge ratio B=2.6 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{21}C	45960#	500#			< 30	ns		$1/2^+$#	00	93Po.A	I	n ?	
^{21}N	25250	100			87	ms	6	$1/2^-$#	00			β^-=100; β^-n=80 6	
^{21}O	8063	12			3.42	s	0.10	$(1,3,5)/2^+$	00			β^-=100	
^{21}F	−47.6	1.8			4.158	s	0.020	$5/2^+$	00			β^-=100	
^{21}Ne	−5731.78	0.04			STABLE			$3/2^+$	00			IS=0.27 1	
^{21}Na	−2184.2	0.7			22.49	s	0.04	$3/2^+$	00			β^+=100	
^{21}Mg	10911	16			122	ms	2	$(5/2,3/2)^+$	00			β^+=100; β^+p=32.6 10; ...	∗
^{21}Al	26120#	300#			< 35	ns		$1/2^+$#	00	93Po.A	I	p ?	

∗^{21}Mg D : ... ; $\beta^+\alpha$<0.5 ∗∗
∗^{21}Mg J : from mirror ^{21}F, there is a preference for $5/2^+$ ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{22}C	53280#	900#			6.2	ms	1.3	0^+	00	03Yo02	TD	β^-=100; β^-n=99 39; ...	∗
^{22}N	32040	190			13.9	ms	1.4		00	03Yo02	T	β^-=100; β^-n=35 5	∗
^{22}O	9280	60			2.25	s	0.15	0^+	00			β^-=100; β^-n<22	
^{22}F	2793	12			4.23	s	0.04	$4^+,(3^+)$	00			β^-=100; β^-n<11	
^{22}Ne	−8024.715	0.018			STABLE			0^+	00			IS=9.25 3	
^{22}Na	−5182.4	0.4			2.6019	y	0.0004	3^+	00			β^+=100	
^{22}Na^m	−4599.4	0.4	583.03	0.09	244	ns	6	1^+	00			IT=100	
^{22}Mg	−397.0	1.3			3.857	s	0.009	0^+	00			β^+=100	
^{22}Al	18180#	90#			59	ms	3	$(3)^+$	00	97Bl03	D	β^+=100; β^+p=44 3; ...	∗
^{22}Si	32160#	200#			29	ms	2	0^+	00	96Bl11	D	β^+=100; β^+p=32 4	

∗^{22}C D : ... ; β^-2n ? D : from 98Yo06 ∗∗
∗^{22}N D : from 90Mu06 ∗∗
∗^{22}Al D : ... ; β^+2p=0.9 5; $\beta^+\alpha$=0.31 9 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{23}N	38400#	300#			14.5	ms	2.4	$1/2^-$#	00	98Yo06	T	β^-=100; β^-n=80 21; β^-2n ?	∗
^{23}O	14610	120			90	ms	40	$1/2^+$#	00	90Mu06	T	β^-=100; β^-n=31 7	
^{23}F	3330	80			2.23	s	0.14	$(3/2,5/2)^+$	00			β^-=100; β^-n<14	
^{23}Ne	−5154.05	0.10			37.24	s	0.12	$5/2^+$	00			β^-=100	
^{23}Na	−9529.8536	0.0027			STABLE			$3/2^+$	00			IS=100.	
^{23}Mg	−5473.8	1.3			11.317	s	0.011	$3/2^+$	00			β^+=100	
^{23}Al	6770	19			470	ms	30	$5/2^+$#	00	95Ti08	D	β^+=100; β^+p=8 4	∗
^{23}Si	23770#	200#			42.3	ms	0.4	$3/2^+$#	00	97Bl04	TD	β^+=100; β^+p≈88; ...	∗

∗^{23}N T : statistical error 1.4, systematics 2.0 estimated by NUBASE ∗∗
∗^{23}Al D : β^+p=3.5(1.9)% from the IAS. Total=3.5×4.8/2.2=7.6% ∗∗
∗^{23}Si D : ... ; β^+2p=3.6 3 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{24}N	47540#	400#			< 52	ns			00	93Po.A	I	n ?	
^{24}O	19070	240			65	ms	5	0^+	00			β^-=100; β^-n=18 6	
^{24}F	7560	70			400	ms	50	$(1,2,3)^+$	00			β^-=100; β^-n<5.9	
^{24}Ne	−5951.5	0.4			3.38	m	0.02	0^+	00			β^-=100	
^{24}Na	−8418.11	0.08			14.9590	h	0.0012	4^+	00			β^-=100	
^{24}Na^m	−7945.90	0.08	472.207	0.009	20.20	ms	0.07	1^+	00			IT≈100; β^-=0.05	
^{24}Mg	−13933.567	0.013			STABLE			0^+	00			IS=78.99 4	
^{24}Al	−56.9	2.8			2.053	s	0.004	4^+	00			β^+=100; $\beta^+\alpha$=0.035 6; ...	∗
^{24}Al^m	368.9	2.8	425.8	0.1	131.3	ms	2.5	1^+	00			IT=82 3; β^+=18 3; ...	∗
^{24}Si	10755	19			140	ms	8	0^+	00	98Cz01	D	β^+=100; β^+p=37.6 25	
^{24}P	32000#	500#						1^+#				p ?; β^+ ?	

∗^{24}Al D : ... ; β^+p=0.0016 3 ∗∗
∗^{24}Al^m D : ... ; $\beta^+\alpha$=0.028 6 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{25}N	56500#	500#				< 260	ns		1/2$^-$#		99Sa06	ID	n ?; 2n ?; β^-=0	*
^{25}O	27440#	260#				< 50	ns		3/2$^+$#	00	93Po.A	I	n ?	
^{25}F	11270	100				50	ms	6	5/2$^+$#	00			β^-=100; β^-n=14 5	
^{25}Ne	−2108	26				602	ms	8	(3/2)$^+$	00			β^-=100	
^{25}Na	−9357.8	1.2				59.1	s	0.6	5/2$^+$	00			β^-=100	
^{25}Mg	−13192.83	0.03				STABLE			5/2$^+$	00			IS=10.00 1	
^{25}Al	−8916.2	0.5				7.183	s	0.012	5/2$^+$	00			β^+=100	
^{25}Si	3824	10				220	ms	3	5/2$^+$	00			β^+=100; β^+p=36.81 5	
^{25}P	18870#	200#				< 30	ns		1/2$^+$#	00	93Po.A	I	p ?	

*^{25}N D : in 99Sa06 experiment, 240 ^{25}N events expected, none observed **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{26}O	35710#	260#				< 40	ns		0$^+$	00	93Po.A	I	2n ?; n=30#; β^-=0	*
^{26}F	18270	170				10.2	ms	1.4	1$^+$	00	99Re16	T	β^-=100; β^-n=11 4	*
^{26}Ne	430	27				197	ms	1	0$^+$	00			β^-=100; β^-n=0.13 3	
^{26}Na	−6862	6				1.077	s	0.005	3$^+$	00			β^-=100	
^{26}Mg	−16214.582	0.027				STABLE			0$^+$	00			IS=11.01 3	
^{26}Al	−12210.31	0.06				717	ky	24	5$^+$	00			β^+=100	
^{26}Al^m	−11982.01	0.06	228.305	0.013		6.3452	s	0.0019	0$^+$	00			β^+=100	
^{26}Si	−7145	3				2.234	s	0.013	0$^+$	00			β^+=100	
^{26}P	10970#	200#				30	ms	25	(3$^+$)	00			β^+=100; β^+2p≈1; …	*
^{26}S	25970#	300#				10#	ms		0$^+$				2p ?	

*^{26}O D : in 96Fa01 and 99Sa06, several 100s of ^{26}O events expected, none observed **
*^{26}F T : other not used 99Dl01=9.6(0.8): same data **
*^{26}P D : … ; β^+p≈0.9 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{27}O	44950#	500#				< 260	ns		3/2$^+$#		99Sa06	I	n ?; 2n ?	
^{27}F	24930	380				4.9	ms	0.2	5/2$^+$#	01	98No.A	T	β^-=100; β^-n=77 21	*
^{27}Ne	7070	110				32	ms	2	3/2$^+$#	01			β^-=100; β^-n=2.0 5	
^{27}Na	−5517	4				301	ms	6	5/2$^+$	01	84Gu19	D	β^-=100; β^-n=0.13 4	
^{27}Mg	−14586.65	0.05				9.458	m	0.012	1/2$^+$	01			β^-=100	
^{27}Al	−17196.66	0.12				STABLE			5/2$^+$	01			IS=100.	
^{27}Si	−12384.30	0.15				4.16	s	0.02	5/2$^+$	01			β^+=100	
^{27}P	−717	26				260	ms	80	1/2$^+$	01			β^+=100; β^+p=0.07	
^{27}S	17540#	200#				21	ms	4	(5/2$^+$)	01			β^+=100; β^+2p=2.0 10;...	*

*^{27}F T : others not used: 99Re16=6.5(1.1) and 97Ta22=5.3(0.9) outweighed; and **
*^{27}F T : 99Dl01=5.2(0.3) same data as in 99Re16 **
*^{27}S D : … ; β^+p=? **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{28}O	53850#	600#				< 100	ns		0$^+$		98Po.A	I	n ?; 2n ?; β^-=0	*
^{28}F	33230#	510#				< 40	ns			01	93Po.A	I	n ?	
^{28}Ne	11240	150				18.3	ms	2.2	0$^+$	01	99Re16	T	β^-=100; β^-n=16 6	*
^{28}Na	−989	13				30.5	ms	0.4	1$^+$	01			β^-=100; β^-n=0.58 12	
^{28}Mg	−15018.6	2.0				20.915	h	0.009	0$^+$	01			β^-=100	
^{28}Al	−16850.44	0.13				2.2414	m	0.0012	3$^+$	01			β^-=100	
^{28}Si	−21492.7968	0.0018				STABLE			0$^+$	01			IS=92.2297 7	
^{28}Si^r	−8951.55	0.12	12541.25	0.12	RQ				3$^+$	01				
^{28}P	−7159	3				270.3	ms	0.5	3$^+$	01	79Ho27	D	β^+=100; β^+p=0.0013 4;...	*
^{28}S	4070	160				125	ms	10	0$^+$	01	89Po10	D	β^+=100; β^+p=20.7 19	
^{28}Cl	26560#	500#							1$^+$#				p ?	

*^{28}O D : in 97Ta22 and 99Sa06, 11 and 37 ^{28}O events expected, none observed **
*^{28}Ne T : average 99Re16=18(3) 97Ta22=21(5) 92Te03=17(4). Others not used: **
*^{28}Ne T : 95Re.A=8.2(2.5) at variance, 99Dl01=20(3) same data as in 99Re16 **
*^{28}P D : … ; $\beta^+\alpha$=0.00086 25 **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{29}F	40300#	580#			2.6	ms	0.3	$5/2^{+}$#	01	99Re16	T	β^-=100; β^-n=60 40; ...	*
^{29}Ne	18060	270			15.6	ms	0.5	$3/2^{+}$#	01	01Be53	D	β^-=100; β^-n=19 4; ...	*
^{29}Na	2665	13			44.9	ms	1.2	$3/2^{(+\#)}$	01	95Re.A	D	β^-=100; β^-n=25.9 23	*
^{29}Mg	−10619	14			1.30	s	0.12	$3/2^{+}$	01			β^-=100	
^{29}Al	−18215.3	1.2			6.56	m	0.06	$5/2^{+}$	01			β^-=100	
^{29}Si	−21895.046	0.021			STABLE			$1/2^{+}$	01			IS=4.6832 5	
^{29}P	−16952.6	0.6			4.142	s	0.015	$1/2^{+}$	01			β^+=100	
^{29}S	−3160	50			187	ms	4	$5/2^{+}$	01	79Vi01	D	β^+=100; β^+p=46.4 10	
^{29}Cl	13140#	200#			< 20	ns		$3/2^{+}$#	01	93Po.A	I	p ?	

*^{29}F D : ... ; β^-2n ? **
*^{29}F T : average 99Re16=2.9(0.8) 98No.A=2.6(0.4) 97Ta22=2.4(0.8). Others not **
*^{29}F T : used: 99Dl01=2.4(0.4) same data as in 99Re16 **
*^{29}F D : β^-n from 99Dl01=100(80)% **
*^{29}Ne D : ... ; β^-2n<2.2 **
*^{29}Ne D : average 01Be53=17 5 99Re16=27 9; other not used: 99Dl01=27(9)%, same **
*^{29}Ne D : data as in 99Re16. β^-2n limit is from 01Be53 **
*^{29}Na D : β^-n: average 95Re.A=27.1(1.6)% 84La03=21.5(3.0)% **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{30}F	48900#	600#			< 260	ns				99Sa06	I	n ?	
^{30}Ne	23100	570			5.8	ms	0.2	0^{+}	01	99Dl01	D	β^-=100; β^-n=13 8	*
^{30}Na	8361	25			48.4	ms	1.7	2^{+}	01	99Dl01	T	β^-=100; β^-n=30 4; ...	*
^{30}Mg	−8911	8			335	ms	17	0^{+}	01	84La03	D	β^-=100; β^-n<0.06	
^{30}Al	−15872	14			3.60	s	0.06	3^{+}	01			β^-=100	
^{30}Si	−24432.928	0.030			STABLE			0^{+}	01			IS=3.0872 5	
^{30}P	−20200.6	0.3			2.498	m	0.004	1^{+}	01			β^+=100	*
^{30}S	−14063	3			1.178	s	0.005	0^{+}	01			β^+=100	
^{30}Cl	4440#	200#			< 30	ns		3^{+}#	01	93Po.A	I	p ?	
^{30}Ar	20080#	300#			< 20	ns		0^{+}		93Po.A	I	2p ?	

*^{30}Ne D : from 9(17)% **
*^{30}Na D : ... ; β^-2n=1.17 16; $\beta^-\alpha$=5.5e–5 20 **
*^{30}Na T : average 99Dl01=50(4) 97Ta22=48(5) 84La02=48(2) **
*^{30}P D : first observed radionuclide, in 1934 **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{31}F	56290#	600#			1#	ms	(>260 ns)	$5/2^{+}$#		99Sa06	I	β^- ?; β^-n ?	
^{31}Ne	30840#	900#			3.4	ms	0.8	$7/2^{-}$#	01			β^-=100; β^-n ?	
^{31}Na	12650	210			17.0	ms	0.4	$(3/2^{+})$	01	93Kl02	J	β^-=100; β^-n=37 5; ...	*
^{31}Mg	−3217	12			230	ms	20	$3/2^{+}$	01	95Re.A	D	β^-=100; β^-n=6.2 20	*
^{31}Al	−14954	20			644	ms	25	$(5/2,3/2)^{+}$	01			β^-=100; β^-n<1.6	*
^{31}Si	−22949.01	0.04			157.3	m	0.3	$3/2^{+}$	01			β^-=100	
^{31}P	−24440.88	0.18			STABLE			$1/2^{+}$	01			IS=100.	
^{31}S	−19044.6	1.5			2.572	s	0.013	$1/2^{+}$	01			β^+=100	
^{31}Cl	−7070	50			150	ms	25	$3/2^{+}$	01	85Ay02	D	β^+=100; β^+p=0.7	*
^{31}Ar	11290#	210#			14.4	ms	0.6	$5/2^{(+\#)}$	01	00Fy01	T	β^+=100; β^+p=63 7; ...	*

*^{31}Na D : ... ; β^-2n=0.9 2; β^-3n<0.05 **
*^{31}Na D : all from 84Gu19 **
*^{31}Mg D : strongly conflicting with earlier 84La03=1.7(0.3)% **
*^{31}Al J : from systematics there is a preference for $5/2^{+}$ **
*^{31}Cl D : β^+p=0.44% for 986 keV protons. Total: 165/100×0.44=0.726% **
*^{31}Ar D : ... ; β^+2p=7.2 11; β^+3p<1.4; β^+pα<0.38; $\beta^+\alpha$<0.03 **
*^{31}Ar D : from 98Ax02 **
*^{31}Ar T : average 00Fy01=14.1(0.7) 92Ba01=15.1(+1.3–1.1) J : from 99Th09 **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{32}Ne	37280#	800#			3.5	ms	0.9	0^{+}	01			β^-=100; β^-n ?	
^{32}Na	19060	360			12.9	ms	0.7	$(3^{-},4^{-})$	01	93Kl02	J	β^-=100; β^-n=24 7; ...	*
^{32}Mg	−955	18			95	ms	16	0^{+}	01			β^-=100; β^-n=2.4 5	
^{32}Al	−11060	90			31.7	ms	0.8	1^{+}	01	95Re.A	TD	β^-=100; β^-n=0.7 5	
^{32}Al^{m}	−10100	90	955.7	0.4	200	ns	20	(4^{+})	01	96Ro02	ETJ		
^{32}Si	−24080.91	0.05			132	y	13	0^{+}	01			β^-=100	
^{32}Si^{m}	−18497.9	1.0	5583.0	1.0	27	ns	2	(5^{-})		97Fo01	ETJ		

... A-group is continued on next page ...

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .													
^{32}P	−24305.22	0.19			14.263	d	0.003	1^+	01	02Un02	T	β^-=100	
^{32}S	−26015.70	0.14			STABLE			0^+	01			IS=94.93 31	
^{32}Cl	−13330	7			298	ms	1	1^+	01	79Ho27	D	β^+=100; $\beta^+\alpha$=0.054 8; . . .	*
^{32}Ar	−2200.2	1.8			98	ms	2	0^+	01			β^+=100; β^+p=43 3	
^{32}Ar^m	3400#	100#	5600#	100#				5^-#				IT ?	
^{32}K	20420#	500#						1^+#				p ?	
^{32}K^m	21370#	510#	950#	100#				4^+#				p ?	
*^{32}Na	D : . . . ; β^-2n=8 2												**
*^{32}Na	T : average 98No.A=11.5(0.8) 84La03=13.2(0.4)												**
*^{32}Cl	D : . . . ; β^+p=0.026 5												**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{33}Ne	46000#	800#			< 260	ns		$7/2^-$#		02No11	I	n ?	*
^{33}Na	24890	870			8.2	ms	0.2	$3/2^+$#	01	02Ra16	TD	β^-=100; β^-n=47 6; . . .	*
^{33}Mg	4894	20			90.5	ms	1.6	$7/2^-$#	01	02Mo29	T	β^-=100; β^-n=17 5	
^{33}Al	−8530	70			41.7	ms	0.2	$5/2^+$#	01	02Mo29	T	β^-=100; β^-n=8.5 7	
^{33}Si	−20493	16			6.18	s	0.18	$(3/2^+)$	01			β^-=100	
^{33}P	−26337.5	1.1			25.34	d	0.12	$1/2^+$	01			β^-=100	
^{33}S	−26585.99	0.14			STABLE			$3/2^+$	01			IS=0.76 2	
^{33}Cl	−21003.4	0.5			2.511	s	0.003	$3/2^+$	01			β^+=100	
^{33}Ar	−9384.1	0.4			173.0	ms	2.0	$1/2^+$	01			β^+=100; β^+p=38.7 10	
^{33}K	6760#	200#			< 25	ns		$3/2^+$#	01	93Po.A	I	p ?	
*^{33}Ne	T : estimated half-life 1# ms for β^- decay				I : also 02Le.A < 1.5 μs								**
*^{33}Na	D : . . . ; β^-2n=13 3												**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{34}Ne	53120#	810#			1#	ms	(>1.5 μs)	0^+		02Le.A	I	β^- ?; β^-n ?	*
^{34}Na	32760#	900#			5.5	ms	1.0	1^+	01	ABBW	D	β^-=100; β^-2n≈50; β^-n≈15	*
^{34}Mg	8810	230			20	ms	10	0^+	01			β^-=100; β^-n ?	
^{34}Al	−2930	110			56.3	ms	0.5	4^-#	01	01Nu01	T	β^-=100; β^-n=12.5 25	*
^{34}Si	−19957	14			2.77	s	0.20	0^+	01			β^-=100	
^{34}P	−24558	5			12.43	s	0.08	1^+	01			β^-=100	
^{34}S	−29931.79	0.11			STABLE			0^+	01			IS=4.29 28	
^{34}Cl	−24439.78	0.18			1.5264	s	0.0014	0^+	01			β^+=100	
^{34}Cl^m	−24293.42	0.18	146.36	0.03	32.00	m	0.04	3^+	01			β^+=55.4 6; IT=44.6 6	
^{34}Ar	−18377.2	0.4			845	ms	3	0^+	01			β^+=100	
^{34}K	−1480#	300#			< 40	ns		1^+#	01	93Po.A	I	p ?	
^{34}Ca	13150#	300#			< 35	ns		0^+	01	93Po.A	I	2p ?	
*^{34}Ne	I : also 02No11 > 260 ns												**
*^{34}Na	D : β^-n≈15%, β^-2n≈50% estimated from $P_n = \beta^-$n + 2×β^-2n=115(20)% in 84La03												**
*^{34}Na	D : assuming β^-n/β^-2n=0.3 from trends in the ^{30}Na-^{33}Na series: 26 41 3 4												**
*^{34}Al	D : from 95Re.A; strongly conflicting with 89Ba50=27(5)% and 88Mu08=54(12)%												**
*^{34}Al	T : also 95Re.A=42(6) ms												**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{35}Na	39580#	950#			1.5	ms	0.5	$3/2^+$#	01			β^-=100; β^-n=?	
^{35}Mg	16150#	400#			70	ms	40	$7/2^-$#	01	95Re.A	D	β^-=100; β^-n=52 46	
^{35}Al	−130	180			38.6	ms	0.4	$5/2^+$#	01	01Nu01	TD	β^-=100; β^-n=41 13	*
^{35}Si	−14360	40			780	ms	120	$7/2^-$#	01	95Re.A	D	β^-=100; β^-n<5	
^{35}P	−24857.7	1.9			47.3	s	0.7	$1/2^+$	01			β^-=100	
^{35}S	−28846.36	0.10			87.51	d	0.12	$3/2^+$	01			β^-=100	
^{35}Cl	−29013.54	0.04			STABLE			$3/2^+$	01			IS=75.78 4	
^{35}Ar	−23047.4	0.7			1.775	s	0.004	$3/2^+$	01			β^+=100	
^{35}K	−11169	20			178	ms	8	$3/2^+$	01			β^+=100; β^+p=0.37 15	
^{35}Ca	4600#	200#			25.7	ms	0.2	$1/2^+$#	01			β^+=100; β^+p=95.7 14; . . .	*
*^{35}Al	T : also 95Re.A=30(4); both strongly conflicting with 89Le16=170(70) and												**
*^{35}Al	T : 88Mu08=130(+100–50)												**
*^{35}Al	D : also 95Re.A=26(4)% 89Le16=40(10)% and 88Mu08=87(+37–25)%												**
*^{35}Ca	D : . . . ; β^+2p=4.2 3												**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{36}Na	47950#	950#				$<$ 260	ns				02No11	I	n ?	*
^{36}Mg	21420#	500#				5#	ms($>$200 ns)		0^+	01	89Gu03	I	β^- ?	
^{36}Al	5780	210				90	ms	40		01			β^-=100; β^-n$<$30	
^{36}Si	−12480	120				450	ms	60	0^+	01	95Re.A	D	β^-=100; β^-n=12 5	
^{36}P	−20251	13				5.6	s	0.3	4^-#	01			β^-=100	
^{36}S	−30664.07	0.19				STABLE			0^+	01			IS=0.02 1	
^{36}Cl	−29521.86	0.07				301	ky	2	2^+	01			β^-=98.1 1; β^+=1.9 1	
^{36}Ar	−30231.540	0.027				STABLE			0^+	01			IS=0.3365 30; 2β^+ ?	
^{36}K	−17426	8				342	ms	2	2^+	01			β^+=100; β^+p=0.048 14; . . .	*
^{36}Ca	−6440	40				102	ms	2	0^+	01	95Tr02	D	β^+=100; β^+p=56.8 13	
^{36}Sc	13900#	500#											p ?	
*^{36}Na	I : also 02Le.A $<$ 1.5 μs													**
*^{36}K	D : . . . ; $\beta^+\alpha$=0.0034 13													**
^{37}Na	55280#	960#				1#	ms($>$1.5 μs)		$3/2^+$#		02Le.A	I	β^- ?; β^-n ?	*
^{37}Mg	29250#	900#				40#	ms($>$260 ns)		$7/2^-$#	01	96Sa34	I	β^- ?; β^-n ?	
^{37}Al	9950	330				20#	ms ($>$1 μs)		$3/2^+$#	01	91Or01	I	β^- ?	
^{37}Si	−6580	170				90	ms	60	$7/2^-$#	01	95Re.A	D	β^-=100; β^-n=17 13	
^{37}P	−18990	40				2.31	s	0.13	$1/2^+$#	01			β^-=100	
^{37}S	−26896.36	0.20				5.05	m	0.02	$7/2^-$	01			β^-=100	
^{37}Cl	−31761.53	0.05				STABLE			$3/2^+$	01			IS=24.22 4	
^{37}Ar	−30947.66	0.21				35.04	d	0.04	$3/2^+$	01			ε=100	
^{37}K	−24800.20	0.09				1.226	s	0.007	$3/2^+$	01			β^+=100	
^{37}Ca	−13162	22				181.1	ms	1.0	$(3/2^+)$	01	95Tr03	D	β^+=100; β^+p=82.1 7	
^{37}Sc	2840#	300#							$7/2^-$#				p ?	
*^{37}Na	I : also 02No11 $>$ 260 ns													**
^{38}Mg	35000#	500#				1#	ms($>$260 ns)		0^+	01	97Sa14	I	β^- ?	*
^{38}Al	16050	730				40#	ms($>$200 ns)			01	89Gu03	I	β^- ?	
^{38}Si	−4070	140				90#	ms ($>$1 μs)		0^+	01	91Zh24	I	β^- ?; β^-n ?	
^{38}P	−14760	100				640	ms	140		01	95Re.A	D	β^-=100; β^-n=12 5	
^{38}S	−26861	7				170.3	m	0.7	0^+	01			β^-=100	
^{38}Cl	−29798.10	0.10				37.24	m	0.05	2^-	01			β^-=100	
^{38}Cl^m	−29126.74	0.10	671.361	0.008		715	ms	3	5^-	01			IT=100	
^{38}Ar	−34714.6	0.3				STABLE			0^+	01			IS=0.0632 5	
^{38}K	−28800.7	0.4				7.636	m	0.018	3^+	01			β^+=100	
^{38}K^m	−28670.2	0.4	130.50	0.28	RQ	923.9	ms	0.6	0^+	01			β^+=100	
^{38}K^n	−25342.7	0.4	3458.0	0.2		21.98	μs	0.11	$(7^+),(5^+)$	01			IT=100	
^{38}Ca	−22059	5				440	ms	8	0^+	01			β^+=100	
^{38}Sc	−4940#	300#				$<$ 300	ns		2^-#	01	94Bl10	I	p ?	
^{38}Sc^m	−4270#	320#	670#	100#					5^-#	01			IT ?; p ?	
^{38}Ti	9100#	250#				$<$ 120	ns		0^+	01	96Bl21	I	2p ?	
*^{38}Mg	I : 18 events reported													**
^{39}Mg	43570#	510#				$<$ 260	ns		$7/2^-$#		02No11	I	n ?	*
^{39}Al	21400	1470				10#	ms($>$200 ns)		$3/2^+$#	01	89Gu03	I	β^- ?	
^{39}Si	1930	340				90#	ms ($>$1 μs)		$7/2^-$#	01	90Au.A	I	β^- ?	
^{39}P	−12870	100				190	ms	50	$1/2^+$#	01	95Re.A	TD	β^-=100; β^-n=26 8	
^{39}S	−23160	50				11.5	s	0.5	$(3,5,7)/2^-$	01			β^-=100	
^{39}Cl	−29800.2	1.7				55.6	m	0.2	$3/2^+$	01			β^-=100	
^{39}Ar	−33242	5				269	y	3	$7/2^-$	01			β^-=100	
^{39}K	−33807.01	0.19				STABLE			$3/2^+$	01			IS=93.2581 44	
^{39}Ca	−27274.4	1.9				859.6	ms	1.4	$3/2^+$	01			β^+=100	
^{39}Sc	−14168	24				$<$ 300	ns		$7/2^-$#	01	94Bl10	I	p=100	*
^{39}Ti	1500#	210#				31	ms	4	$3/2^+$#	01	90De43	TD	β^+=100; . . .	*
*^{39}Mg	T : estimated half-life 1# ms for β^- decay													**
*^{39}Sc	D : most probably proton emitter from S_p=–602(24) keV													**
*^{39}Ti	D : . . . ; β^+p=85 15; β^+2p=15# D : β^+2p decay observed by 92Mo15													**
*^{39}Ti	T : average 90De43=26(+8–7) 01Gi01=31(+6–4)													**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{40}Mg	50240#	900#				1#	ms		0^+		02No11	I	β^- ?; β^-n ?	*
^{40}Al	29300#	700#				10#	ms (>260 ns)			02	97Sa14	I	β^- ?; β^-n ?	*
^{40}Si	5470	560				20#	ms (>200 ns)		0^+	02	89Gu03	I	β^- ?; β^-n ?	
^{40}P	−8110	140				153	ms	8	$(2^-,3^-)$	02			β^-=100; ...	*
^{40}S	−22870	140				8.8	s	2.2	0^+	02			β^-=100	
^{40}Cl	−27560	30				1.35	m	0.02	2^-	02			β^-=100	
^{40}Ar	−35039.8960	0.0027				STABLE			0^+	02			IS=99.6003 30	
^{40}K	−33535.20	0.19				1.251	Gy	0.011	4^-	02			IS=0.0117 1; ...	*
^{40}K^m	−31891.56	0.19	1643.639	0.011		336	ns	12	0^+	02			IT=100	
^{40}Ca	−34846.27	0.21				STABLE	(>5.9 Zy)		0^+	01	99Be64	T	IS=96.941 156; 2β^+ ?	
^{40}Sc	−20523.2	2.8				182.3	ms	0.7	4^-	02			β^+=100; ...	*
^{40}Ti	−8850	160				53.3	ms	1.5	0^+	02			β^+=100; β^+p=100	
^{40}V	10330#	500#							2^-#				p ?	

*^{40}Mg I : one event expected, none observed; similar search in 02Le.A **
*^{40}Al I : 34 events reported in 97Sa14; also one event in 96Sa34 **
*^{40}P D : ...; β^-n=15.8 21 **
*^{40}K D : ...; β^-=89.28 13; β^+=10.72 13 **
*^{40}Sc D : ...; β^+p=0.44 7; $\beta^+\alpha$=0.017 5 **

^{41}Al	35700#	800#				2#	ms (>260 ns)		$3/2^+$#	02	97Sa14	I	β^- ?	*
^{41}Si	13560	1840				30#	ms (>200 ns)		$7/2^-$#	02	89Gu03	I	β^- ?	
^{41}P	−5280	220				150	ms	15	$1/2^+$#	02			β^-=100; β^-n=30 10	
^{41}S	−19020	120				1.99	s	0.05	$7/2^-$#	02			β^-=100; β^-n ?	
^{41}Cl	−27310	70				38.4	s	0.8	$(1/2,3/2^+)$	02			β^-=100	
^{41}Ar	−33067.5	0.3				109.61	m	0.04	$7/2^-$	02			β^-=100	
^{41}K	−35559.07	0.19				STABLE			$3/2^+$	02			IS=6.7302 44	
^{41}Ca	−35137.76	0.24				102	ky	7	$7/2^-$	02			ε=100	
^{41}Sc	−28642.39	0.23				596.3	ms	1.7	$7/2^-$	02			β^+=100	
^{41}Sc^r	−25760.10	0.23	2882.30	0.05	RQ				$7/2^+$	02			P=59 2; IT=41 2	
^{41}Ti	−15700#	100#				80.9	ms	1.2	$3/2^+$	02	98Bh12	T	β^+=100; β^+p≈100	*
^{41}V	−210#	210#							$7/2^-$#				p ?	

*^{41}Al I : reported 4 events **
*^{41}Ti T : average 98Bh12=81.3(2.0) 98Li46=82(3) 96Fa09=81(4) 74Se11=80(2) **

^{42}Al	43680#	900#				1#	ms						β^- ?; β^-n ?	
^{42}Si	18430#	500#				5#	ms (>200 ns)		0^+	01	90Le03	I	β^- ?; β^-n ?	*
^{42}P	940	450				120	ms	30		01	89Le16	T	β^-=100; β^-n=50 20	
^{42}S	−17680	120				1.013	s	0.015	0^+	01			β^-=100; β^-n<4	
^{42}Cl	−24910	140				6.8	s	0.3		01			β^-=100	
^{42}Ar	−34423	6				32.9	y	1.1	0^+	01			β^-=100	
^{42}K	−35021.56	0.22				12.360	h	0.012	2^-	01			β^-=100	
^{42}Ca	−38547.07	0.25				STABLE			0^+	01			IS=0.647 23	
^{42}Sc	−32121.24	0.27				681.3	ms	0.7	0^+	01			β^+=100	
^{42}Sc^m	−31504.96	0.28	616.28	0.06		61.7	s	0.4	$(7,5,6)^+$	01			β^+=100	
^{42}Sc^r	−26044.91	0.26	6076.33	0.08	RQ				$(1^+ to 4^+)$	01			IT=100	
^{42}Ti	−25122	5				199	ms	6	0^+	01			β^+=100	
^{42}V	−8170#	200#				< 55	ns		2^-#	01	92Bo37	I	p ?	
^{42}Cr	5990#	300#				14	ms	3	0^+	01	01Gi01	TD	β^+≈100; β^+p=?; 2p ?	

*^{42}Si TD : ENSDF reports preliminary values from 98Yo.A: half-life=20 ms 10 and **
*^{42}Si TD : %β^-n=103 48, subject to further analysis according to the authors **

^{43}Si	26700#	700#				15#	ms (>260 ns)		$3/2^-$#		02No11	I	β^- ?; β^-n ?	
^{43}P	5770	970				33	ms	3	$1/2^+$#	01			β^-=100; β^-n=100	
^{43}S	−11970	200				260	ms	15	$3/2^-$#	01	98Wi.A	T	β^-=100; β^-n=40 10	
^{43}S^m	−11650	200	319	5		480	ns	50	$(7/2^-)$	01	00Sa21	EJ	IT=100	*
^{43}Cl	−24170	160				3.07	s	0.07	$3/2^+$#	01			β^-=100; β^-n ?	
^{43}Ar	−32010	5				5.37	m	0.06	$(5/2^-)$	01			β^-=100	
^{43}K	−36593	9				22.3	h	0.1	$3/2^+$	01			β^-=100	
^{43}Ca	−38408.6	0.3				STABLE			$7/2^-$	01			IS=0.135 10	

... *A*-group is continued on next page ...

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{43}Sc	−36187.9	1.9				3.891	h	0.012	$7/2^-$	01			β^+=100	
^{43}Sc^m	−36036.5	1.9	151.4	0.2		438	μs	7	$3/2^+$	01			IT=100	
^{43}Ti	−29321	7				509	ms	5	$7/2^-$	01			β^+=100	
^{43}Ti^m	−29008	7	313.0	1.0		12.6	μs	0.6	$(3/2^+)$	01			IT=100	
^{43}Ti^n	−26255	7	3066.4	1.0		560	ns	6	$(19/2^-)$	01			IT=100	
^{43}V	−18020#	230#				80#	ms		$7/2^-$#	01			β^+ ?	*
^{43}Cr	−2130#	220#				21.6	ms	0.7	$(3/2^+)$	01			β^+=100; β^+p=23 6; . . .	*

*^{43}S^m J : from comparison of B(E2) and half-life with theoretical ones **
*^{43}V T : >800 ms reported by 92Bo37 and adopted in ENSDF'01. To be confirmed. **
*^{43}Cr D : . . . ; β^+2p=6 5; $\beta^+\alpha$? **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{44}Si	32840#	800#				10#	ms		0^+				β^- ?; β^-n ?	
^{44}P	12100#	700#				30#	ms	(>200 ns)		99	89Gu03	I	β^- ?	
^{44}S	−9120	390				123	ms	10	0^+	99			β^-=100; β^-n=18 3	
^{44}Cl	−20230	110				560	ms	110		99			β^-=100; β^-n<8	
^{44}Ar	−32673.1	1.6				11.87	m	0.05	0^+	99			β^-=100	
^{44}K	−35810	40				22.13	m	0.19	2^-	99			β^-=100	
^{44}Ca	−41468.5	0.4				STABLE			0^+	99			IS=2.086 110	
^{44}Sc	−37816.1	1.8				3.97	h	0.04	2^+	99			β^+=100	
^{44}Sc^m	−37545.2	1.8	270.95	0.20		58.61	h	0.10	6^+	99			IT=98.80 7; β^+=1.20 7	
^{44}Sc^n	−37669.9	1.8	146.224	0.022		50.4	μs	0.7	0^-	99				
^{44}Ti	−37548.5	0.7				60.0	y	1.1	0^+	99			ε=100	*
^{44}V	−24120	120			*	111	ms	7	(2^+)	99			β^+=100; $\beta^+\alpha$=?	
^{44}V^m	−23850#	160#	270#	100#	*	150	ms	3	(6^+)	99			β^+=100	
^{44}V^n	−23970#	160#	150#	100#					0^-#					
^{44}Cr	−13460#	50#				54	ms	4	0^+	99	96Fa09	D	β^+=100; β^+p=7 3	
^{44}Mn	6400#	500#				< 105	ns		2^-#	99			p ?	

*^{44}Ti T : also 01Ha21=59(2) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{45}P	17900#	800#				8#	ms	(>200 ns)	$1/2^+$#	93	90Le03	I	β^- ?	
^{45}S	−3250	1740				82	ms	13	$3/2^-$#	97			β^-=100; β^-n=54	
^{45}Cl	−18360	120				400	ms	40	$3/2^+$#	95			β^-=100; β^-n=24 4	
^{45}Ar	−29770.6	0.5				21.48	s	0.15	$(1,3,5)/2^-$	95			β^-=100	*
^{45}K	−36608	10				17.3	m	0.6	$3/2^+$	95			β^-=100	
^{45}Ca	−40812.0	0.4				162.67	d	0.25	$7/2^-$	95	94Lo04	T	β^-=100	
^{45}Sc	−41067.8	0.8				STABLE			$7/2^-$	95			IS=100.	
^{45}Sc^m	−41055.4	0.8	12.40	0.05		318	ms	7	$3/2^+$	95			IT=100	
^{45}Ti	−39005.7	1.0				184.8	m	0.5	$7/2^-$	95			β^+=100	
^{45}V	−31880	17				547	ms	6	$7/2^-$	95			β^+=100	
^{45}Cr	−18970	500			*	50	ms	6	$7/2^-$#	95			β^+=100; β^+p>27	
^{45}Cr^m	−18920#	510#	50#	100#	*	1#	ms		$3/2^+$#				IT ?; β^+ ?	
^{45}Mn	−5110#	300#				< 70	ns		$7/2^-$#	97	92Bo37	I	p ?	
^{45}Fe	13580#	220#				4.9	ms	1.5	$3/2^+$#	97	02Gi09	TD	2p=75 5; β^+=25 5; . . .	*

*^{45}Ar J : $7/2^-$# is expected from theory and from systematics. See ENSDF. **
*^{45}Fe D : . . . ; β^+p=25 5 **
*^{45}Fe T : average 02Gi09=4.7(+3.4–1.4) 02Pf02=3.2(+2.6–1.0) D : β^+p from 01Gi01 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{46}P	25500#	900#				4#	ms	(>200 ns)		00	90Le03	I	β^- ?	
^{46}S	700#	700#				30#	ms	(>200 ns)	0^+	00	89Gu03	I	β^- ?	
^{46}Cl	−14710	720				220	ms	40		00			β^-=100; β^-n=60 9	
^{46}Ar	−29720	40				8.4	s	0.6	0^+	00			β^-=100	
^{46}K	−35418	16				105	s	10	$2^{(-)}$	00	82To02	J	β^-=100	
^{46}Ca	−43135.1	2.3				STABLE		(>100 Ey)	0^+	00	99Be64	T	IS=0.004 3; 2β^- ?	*
^{46}Sc	−41757.1	0.8				83.79	d	0.04	4^+	00			β^-=100	
^{46}Sc^m	−41614.6	0.8	142.528	0.007		18.75	s	0.04	1^-	00			IT=100	
^{46}Ti	−44123.4	0.8				STABLE			0^+	00			IS=8.25 3	
^{46}V	−37073.0	1.0				422.50	ms	0.11	0^+	00			β^+=100	
^{46}V^m	−36271.5	1.0	801.46	0.10		1.02	ms	0.07	3^+	00			IT=100	

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{46}Cr	−29474	20				260	ms	60	0^+	00			β^+=100	
^{46}Mn	−12370#	110#			∗	37	ms	3	(4^+)	00	92Bo37	TD	β^+=100; β^+p=22 2; . . .	∗
^{46}Mn^m	−12220#	150#	150#	100#	∗	1#	ms		1^-#				β^+ ?	
^{46}Fe	760#	350#				9	ms	4	0^+	00	01Gi01	TD	β^+=100; β^+p=36 20	

∗^{46}Ca T : limit is for neutrinoless $\beta\beta$ decay ∗∗
∗^{46}Mn D : . . . ; β^+2p≈18; $\beta^+\alpha$? ∗∗
∗^{46}Mn T : average 92Bo37=41(+7–6) 01Gi01=34.0(+4.5–3.5) ∗∗
∗^{46}Mn D : β^+2p≈18% estimated from $P_p = \beta^+$p + 2×β^+2p=58(9)% in 01Gi01 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{47}S	8000#	800#				20#	ms	(>200 ns)	$3/2^-$#	95	89Gu03	I	β^- ?	
^{47}Cl	−10520#	600#				200#	ms	(>200 ns)	$3/2^+$#	95	89Gu03	I	β^-=100; β^-n<3	
^{47}Ar	−25910	100				580	ms	120	$3/2^-$#	95	89Ba.B	T	β^-=100; β^-n<1	∗
^{47}K	−35696	8				17.50	s	0.24	$1/2^+$	95			β^-=100	
^{47}Ca	−42340.1	2.3				4.536	d	0.003	$7/2^-$	95			β^-=100	
^{47}Sc	−44332.1	2.0				3.3492	d	0.0006	$7/2^-$	95			β^-=100	
^{47}Sc^m	−43565.3	2.0	766.83	0.09		272	ns	8	$(3/2)^+$	95			IT=100	
^{47}Ti	−44932.4	0.8				STABLE			$5/2^-$	95			IS=7.44 2	
^{47}V	−42002.1	0.8				32.6	m	0.3	$3/2^-$	95			β^+=100	
^{47}Cr	−34558	14				500	ms	15	$3/2^-$	95			β^+=100	
^{47}Mn	−22260#	160#				100	ms	50	$5/2^-$#	95	96Fa09	TD	β^+=100; β^+p=3.4 9	
^{47}Fe	−6620#	260#				21.8	ms	0.7	$7/2^-$#	97	01Gi01	TD	β^+=100; β^+p=87 7	
^{47}Fe^m	−5850#	280#	770#	100#					$3/2^+$#				IT ?	
^{47}Co	10700#	500#							$7/2^-$#				p ?	

∗^{47}Ar D : from 95So03 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{48}S	13200#	900#				10#	ms	(>200 ns)	0^+		90Le03	I	β^- ?	
^{48}Cl	−4700#	700#				100#	ms	(>200 ns)			89Gu03	I	β^- ?	
^{48}Ar	−23720#	300#				500#	ms		0^+				β^- ?	
^{48}K	−32124	24				6.8	s	0.2	(2^-)	95			β^-=100; β^-n=1.14 15	
^{48}Ca	−44214	4				53	Ey	17	0^+	95	00Br63	T	IS=0.187 21; . . .	∗
^{48}Sc	−44496	5				43.67	h	0.09	6^+	95			β^-=100	
^{48}Ti	−48487.7	0.8				STABLE			0^+	95			IS=73.72 3	
^{48}V	−44475.4	2.6				15.9735	d	0.0025	4^+	95			β^+=100	
^{48}Cr	−42819	7				21.56	h	0.03	0^+	95			β^+=100	
^{48}Mn	−29320	110				158.1	ms	2.2	4^+	97	87Se07	D	β^+=100; β^+p=0.28 4; . . .	∗
^{48}Fe	−18160#	70#				44	ms	7	0^+	95	96Fa09	TD	β^+=100; β^+p=3.6 11	
^{48}Co	1640#	400#							6^+#				p ?	
^{48}Ni	18400#	500#				10#	ms	(>500 ns)	0^+	01	00Bl01	I	2p ?	

∗^{48}Ca D : . . . ; $2\beta^-$=?; β^- ? ∗∗
∗^{48}Ca T : average 00Br63=42(33-13) 96Ba80=43(+24–11 statistics + 14 systematics) ∗∗
∗^{48}Ca T : also T>36 Ey from 70Ba61. Single β^- decay: T>6 Ey (95% CL), from 85Al17 ∗∗
∗^{48}Mn D : . . . ; $\beta^+\alpha$=6e–4 ∗∗
∗^{48}Mn D : one $\beta^+\alpha$ event was observed, versus 437 β^+p, in fig.4 of 87Se07 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{49}S	22000#	950#				< 200	ns		$3/2^-$#	97	90Le03	I	n ?	∗
^{49}Cl	300#	800#				50#	ms	(>200 ns)	$3/2^+$#	95	89Gu03	I	β^- ?	
^{49}Ar	−18150#	500#				170	ms	50	$3/2^-$#	95	03We09	TD	β^-=100; β^-n=65 20	
^{49}K	−30320	70				1.26	s	0.05	$(3/2^+)$	95			β^-=100; β^-n=86 9	
^{49}Ca	−41289	4				8.718	m	0.006	$3/2^-$	95			β^-=100	
^{49}Sc	−46552	4				57.2	m	0.2	$7/2^-$	95			β^-=100	
^{49}Ti	−48558.8	0.8				STABLE			$7/2^-$	95			IS=5.41 2	
^{49}V	−47956.9	1.2				330	d	15	$7/2^-$	95			ε=100	
^{49}Cr	−45330.5	2.4				42.3	m	0.1	$5/2^-$	95			β^+=100	
^{49}Mn	−37616	24				382	ms	7	$5/2^-$	01			β^+=100	
^{49}Fe	−24580#	150#				70	ms	3	$(7/2^-)$	01	96Fa09	J	β^+=100; β^+p=52 10	
^{49}Co	−9580#	260#				< 35	ns		$7/2^-$#	97	94Bl10	I	p ?	
^{49}Ni	9000#	400#				13	ms	4	$7/2^-$#	97	01Gi01	TD	β^+=100; β^+p=?	

∗^{49}S I : statistics precludes any conclusion, say authors ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{50}Cl	7300#	900#				20#	ms						β^- ?	
^{50}Ar	−14500#	700#				85	ms	30	0^+	95	03We09	TD	β^-=100; β^-n=35 10	
^{50}K	−25350	280				472	ms	4	$(0^-,1,2^-)$	95			β^-=100; β^-n=29 3	
^{50}Ca	−39571	9				13.9	s	0.6	0^+	95			β^-=100	
^{50}Sc	−44537	16				102.5	s	0.5	5^+	95			β^-=100	
^{50}Sc^m	−44280	16	256.895	0.010		350	ms	40	$2^+,3^+$	95			IT>97.5; β^-<2.5	
^{50}Ti	−51426.7	0.8				STABLE			0^+	95			IS=5.18 2	
^{50}V	−49221.6	1.0				150	Py	40	6^+	95			IS=0.250 4; β^+=83 11;...	*
^{50}Cr	−50259.5	1.0				STABLE		(>1.3 Ey)	0^+	95	03Bi05	T	IS=4.345 13; 2β^+ ?	
^{50}Mn	−42626.8	1.0				283.9	ms	0.5	0^+	95			β^+=100	
^{50}Mn^m	−42398	7	229	7		1.75	m	0.03	5^+	95			β^+=100	
^{50}Fe	−34480	60				155	ms	11	0^+	01			β^+=100; β^+p≈0	
^{50}Co	−17200#	170#				44	ms	4	(6^+)	01	96Fa09	JD	β^+=100; β^+p=54 12	
^{50}Ni	−3790#	260#				9.1	ms	1.8	0^+	97	01Ma.A	T	β^+ ?	

*^{50}V D : . . . ; β^-=17 11 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{51}Cl	13500#	1000#				2#	ms	(>200 ns)	$3/2^+$#	97	90Le03	I	β^- ?	
^{51}Ar	−7800#	700#				60#	ms	(>200 ns)	$3/2^-$#	97	89Gu03	I	β^- ?	
^{51}K	−22000#	500#				365	ms	5	$3/2^+$#	97			β^-=100; β^-n=47 5	
^{51}Ca	−35860	90				10.0	s	0.8	$3/2^-$#	97			β^-=100; β^-n ?	
^{51}Sc	−43218	20				12.4	s	0.1	$(7/2)^-$	97			β^-=100	
^{51}Ti	−49727.8	1.0				5.76	m	0.01	$3/2^-$	97			β^-=100	
^{51}V	−52201.4	1.0				STABLE			$7/2^-$	97			IS=99.750 4	
^{51}Cr	−51448.8	1.0				27.7025	d	0.0024	$7/2^-$	97			ε=100	
^{51}Mn	−48241.3	1.0				46.2	m	0.1	$5/2^-$	97			β^+=100	
^{51}Fe	−40222	15				305	ms	5	$5/2^-$	97			β^+=100	
^{51}Co	−27270#	150#				60#	ms	(>200 ns)	$7/2^-$#	97	87Po04	I	β^+ ?	
^{51}Ni	−11440#	260#				30#	ms	(>200 ns)	$7/2^-$#	97	87Po04	I	β^+ ?	

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{52}Ar	−3000#	900#				10#	ms		0^+	00			β^- ?	
^{52}K	−16200#	700#				105	ms	5	2^-#	00	ABBW	D	β^-=100; β^-n≈64; . . .	*
^{52}Ca	−32510	700				4.6	s	0.3	0^+	00			β^-=100; β^-n<2	
^{52}Sc	−40360	190				8.2	s	0.2	$3^{(+)}$	00			β^-=100	
^{52}Ti	−49465	7				1.7	m	0.1	0^+	00			β^-=100	
^{52}V	−51441.3	1.0				3.743	m	0.005	3^+	00			β^-=100	
^{52}Cr	−55416.9	0.8				STABLE			0^+	00			IS=83.789 18	
^{52}Mn	−50705.4	2.0				5.591	d	0.003	6^+	00			β^+=100	
^{52}Mn^m	−50327.7	2.0	377.749	0.005		21.1	m	0.2	2^+	00			β^+=98.25 5; IT=1.75 5	
^{52}Fe	−48332	7				8.275	h	0.008	0^+	00			β^+=100	
^{52}Fe^m	−41520	130	6810	130	BD	45.9	s	0.6	12^+#	00			β^+≈100; IT<0.004	
^{52}Co	−33920#	70#				115	ms	23	(6^+)	00			β^+=100	
^{52}Co^m	−33540#	120#	380#	100#		104	ms	11	2^+#		97Ha04	TD	β^+=?; IT ?	*
^{52}Ni	−22650#	80#				38	ms	5	0^+	00			β^+=100; β^+p=17.0 14	
^{52}Cu	−2630#	260#							3^+#	00			p ?	

*^{52}K D : . . . ; β^-2n≈21 **

*^{52}K D : β^-n≈64%, β^-2n≈21% estimated from $P_n = \beta^-$n + 2×β^-2n=107(20)% in 83La23 **

*^{52}K D : and assuming β^-n/β^-2n=3 as in ^{32}Na **

*^{52}Co^m I : tentative: no specific evidence for ^{52}Co^m, say authors in 97Ha04 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{53}Ar	4600#	1000#				3#	ms		$5/2^-$#	99			β^- ?; β^-n ?	
^{53}K	−12000#	700#				30	ms	5	$3/2^+$#	99	ABBW	D	β^-=100; β^-n≈67; . . .	∗
^{53}Ca	−27900#	500#				90	ms	15	$3/2^-$#	99	83La23	D	β^-=100; β^-n>30	∗
^{53}Sc	−37620#	300#				> 3	s		$7/2^-$#	99	98So03	TD	β^-=100; β^-n ?	
^{53}Ti	−46830	100				32.7	s	0.9	$(3/2)^-$	99			β^-=100	
^{53}V	−51849	3				1.60	m	0.04	$7/2^-$	99			β^-=100	
^{53}Cr	−55284.7	0.8				STABLE			$3/2^-$	99			IS=9.501 17	
^{53}Mn	−54687.9	0.8				3.7	My	0.4	$7/2^-$	99			ε=100	
^{53}Fe	−50945.3	1.8				8.51	m	0.02	$7/2^-$	99			β^+=100	
^{53}Fe^m	−47904.9	1.8	3040.4	0.3		2.526	m	0.024	$19/2^-$	99	97Ge11	T	IT=100	∗
^{53}Co	−42645	18				242	ms	8	$7/2^-$#	99	02Lo13	T	β^+=100	∗
^{53}Co^m	−39447	22	3197	29	p	247	ms	12	$(19/2^-)$	99			β^+≈98.5; p≈1.5	
^{53}Ni	−29370#	160#				45	ms	15	$7/2^-$#	99	76Vi02	D	β^+=100; β^+p≈45	
^{53}Cu	−13460#	260#				< 300	ns		$3/2^-$#	99	93Bl.A	I	p ?; β^+ ?	
∗^{53}K	D : . . . ; β^-2n≈17													∗∗
∗^{53}K	D : β^-n≈67%, β^-2n≈17% estimated from $P_n = \beta^-$n + 2×β^-2n=100(30)% in 83La23													∗∗
∗^{53}K	D : and assuming β^-n/β^-2n=4 as in ^{33}Na													∗∗
∗^{53}Ca	D : β^-n=40(10)% is a lower limit (see ENSDF)													∗∗
∗^{53}Ca	T : expected T=2# s from systematics of Ca isotopes													∗∗
∗^{53}Fe^m	T : average 97Ge11=2.48(0.05) 68De27=2.51(0.02) 67Es06=2.58(0.03)													∗∗
∗^{53}Co	T : average 02Lo13=240(9) 89Ho13=240(20) 73Ko10=262(25)													∗∗
^{54}K	−5400#	900#				10	ms	5	2^-#	01			β^-=100; β^-n=?	
^{54}Ca	−23890#	700#				50#	ms	(>300 ns)	0^+	01	97Be70	I	β^- ?; β^-n ?	
^{54}Sc	−34220	370				260	ms	30	3^+#	01	02Ja16	T	β^-=100; β^-n ?	∗
^{54}Sc^m	−34110	370	110	3		7	μs	5	(5^+)	01	98Gr14	EJ	IT=100	
^{54}Ti	−45590	120				1.5	s	0.4	0^+	01			β^-=100	
^{54}V	−49891	15				49.8	s	0.5	3^+	01			β^-=100	
^{54}V^m	−49783	15	108	3		900	ns	500	(5^+)		98Gr14	EJ	IT=100	
^{54}Cr	−56932.5	0.8				STABLE			0^+	01			IS=2.365 7	
^{54}Mn	−55555.4	1.3				312.03	d	0.03	3^+	01	02Un02	T	ε=100; β^-<2.9e–4; . . .	∗
^{54}Fe	−56252.5	0.7				STABLE			0^+	01			IS=5.845 35; 2β^+ ?	
^{54}Fe^m	−49725.6	0.9	6526.9	0.6		364	ns	7	10^+	01			IT=100	
^{54}Co	−48009.5	0.7				193.23	ms	0.14	0^+	01			β^+=100	
^{54}Co^m	−47812.1	0.9	197.4	0.5		1.48	m	0.02	$(7)^+$	01			β^+=100	
^{54}Ni	−39210	50				104	ms	7	0^+	01	02Lo13	T	β^+=100	∗
^{54}Cu	−21690#	210#				< 75	ns		3^+#	01	94Bl10	I	p ?	
^{54}Zn	−6570#	400#							0^+				2p ?	
∗^{54}Sc	T : average 02Ja16=360(60) 98So03=225(40)													∗∗
∗^{54}Mn	D : . . . ; e$^+$=1.28e–7 25													∗∗
∗^{54}Mn	D : e$^+$ average 98Wu01=1.20(0.26) 97Za07=2.2(0.9)													∗∗
∗^{54}Ni	T : average 02Lo13=103(9) 99Re06=106(12)													∗∗
^{55}K	−270#	1000#				3#	ms		$3/2^+$#				β^- ?; β^-n ?	
^{55}Ca	−18120#	700#				30#	ms	(>300 ns)	$5/2^-$#		97Be70	I	β^- ?	
^{55}Sc	−29580	740				120	ms	40	$7/2^-$#	01			β^-=100; β^-n ?	
^{55}Ti	−41670	150				490	ms	90	$3/2^-$#	01	98Am04	T	β^-=100	∗
^{55}V	−49150	100				6.54	s	0.15	$7/2^-$#	01			β^-=100	
^{55}Cr	−55107.5	0.8				3.497	m	0.003	$3/2^-$	01			β^-=100	
^{55}Mn	−57710.6	0.7				STABLE			$5/2^-$	01			IS=100.	
^{55}Fe	−57479.4	0.7				2.737	y	0.011	$3/2^-$	01			ε=100	
^{55}Co	−54027.6	0.7				17.53	h	0.03	$7/2^-$	01			β^+=100	
^{55}Ni	−45336	11				204.7	ms	1.7	$7/2^-$	01	02Lo13	T	β^+=100	∗
^{55}Cu	−31620#	300#				40#	ms	(>200 ns)	$3/2^-$#	01	87Po04	I	β^+ ?; p ?	
^{55}Zn	−14920#	250#				20#	ms	(>1.6 μs)	$5/2^-$#	01	01Gi10	I	β^+ ?	
∗^{55}Ti	T : unweighed average 98Am04=320(60) 96Do23=600(40) and 95So.A=545(95)													∗∗
∗^{55}Ti	T : (Birge ratio B=2.75)													∗∗
∗^{55}Ni	T : average 02Lo13=196(5) 99Re06=204(3) 87Ha.A=212.1(3.8) 84Ay01=208(5)													∗∗
∗^{55}Ni	T : and 77Ho25=189(5) 76Ed.A=219(6); 97Wo06=204(3) superseded by 99Re06													∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{56}Ca	−13440#	900#				10#	ms	(>300 ns)	0^+	99	97Be70	I	β^- ?	
^{56}Sc	−25270#	700#				80#	ms	(>300 ns)	3^+#	99	97Be70	I	β^- ?	
^{56}Ti	−38940	200				164	ms	24	0^+	99	98Am04	TD	β^-=100; β^-n ?	*
^{56}V	−46080	200				216	ms	4	(1^+)	99	03Ma02	TJ	β^-=100; β^-n ?	
^{56}Cr	−55281.2	1.9				5.94	m	0.10	0^+	99			β^-=100	
^{56}Mn	−56909.7	0.7				2.5789	h	0.0001	3^+	99			β^-=100	
^{56}Fe	−60605.4	0.7				STABLE			0^+	99			IS=91.754 36	
^{56}Co	−56039.4	2.1				77.23	d	0.03	4^+	99			β^+=100	
^{56}Ni	−53904	11				6.075	d	0.010	0^+	99			β^+=100	
^{56}Cu	−38600#	140#				93	ms	3	(4^+)	99	01Bo54	TJD	β^+=100; β^+p=0.40 12	
^{56}Zn	−25730#	260#				36	ms	10	0^+	01	95Wa.A	T	β^+ ?; β^+p ?	*
^{56}Ga	−4740#	260#							3^+#				p ?	

*^{56}Ti T : average 98Am04=190(40) 96Do23=150(30) **
*^{56}Zn T : half-life is derived from experimental (p,n) cross sections **
*^{56}Zn I : identified by time-of-flight 01Gi10 with T>1.6 μs **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{57}Ca	−7120#	1000#				5#	ms		$5/2^-$#				β^- ?; β^-n ?	
^{57}Sc	−20690#	700#				13	ms	4	$7/2^-$#	98	02So.A	TD	β^-=100; β^-n=33#	
^{57}Ti	−33540	460				60	ms	16	$5/2^-$#	98	99So20	T	β^-=100; β^-n=0.3#	*
^{57}V	−44190	230				350	ms	10	$(3/2^-)$	98	03Ma02	TJ	β^-=100; β^-n=0.4#	
^{57}Cr	−52524.1	1.9				21.1	s	1.0	$(3/2^-)$	98			β^-=100	
^{57}Mn	−57486.8	1.8				85.4	s	1.8	$5/2^-$	98			β^-=100	
^{57}Fe	−60180.1	0.7				STABLE			$1/2^-$	98			IS=2.119 10	
^{57}Co	−59344.2	0.7				271.74	d	0.06	$7/2^-$	98			ε=100	
^{57}Ni	−56082.0	1.8				35.60	h	0.06	$3/2^-$	98			β^+=100	
^{57}Cu	−47310	16				196.3	ms	0.7	$3/2^-$	98			β^+=100	
^{57}Zn	−32800#	100#				38	ms	4	$7/2^-$#	98	02Lo13	T	β^+=100; β^+p≈65	*
^{57}Ga	−15900#	260#							$1/2^-$#				p ?	

*^{57}Ti T : average 99So20=67(25) 96Do23=56(20); 98Am04=180(30) at variance not used **
*^{57}Zn T : average 02Lo13=37(5) 76Vi02=40(10) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{58}Sc	−15170#	800#				12	ms	5	3^+#		02So.A	TD	β^-=100	
^{58}Ti	−30770#	700#				54	ms	7	0^+	97	99So20	TD	β^-=100	*
^{58}V	−40210	250				191	ms	8	3^+#	97	03Ma02	TD	β^-=100; β^-n ?	*
^{58}Cr	−51830	200				7.0	s	0.3	0^+	97			β^-=100	
^{58}Mn	−55910	30				3.0	s	0.1	1^+	97			β^-=100	
^{58}Mn^m	−55840	30	71.78	0.05		65.2	s	0.5	$(4)^+$	97			β^-=?; IT=20#	
^{58}Fe	−62153.4	0.7				STABLE			0^+	97			IS=0.282 4	
^{58}Co	−59845.9	1.2				70.86	d	0.06	2^+	00			β^+=100	
^{58}Co^m	−59821.0	1.2	24.95	0.06		9.04	h	0.11	5^+	00			IT=100	
^{58}Co^n	−59792.8	1.2	53.15	0.07		10.4	μs	0.3	4^+	00			IT=100	
^{58}Ni	−60227.7	0.6				STABLE		(>700 Ey)	0^+	01			IS=68.0769 89; 2β^+ ?	*
^{58}Cu	−51662.1	1.6				3.204	s	0.007	1^+	01			β^+=100	
^{58}Zn	−42300	50				84	ms	9	0^+	99	02Lo13	T	β^+=100; β^+p<3	*
^{58}Ga	−23990#	210#			*				2^+#				p ?	
^{58}Ga^m	−23960#	230#	30#	100#	*				5^+#				p ?	
^{58}Ge	−8370#	320#							0^+				2p ?	

*^{58}Ti T : average 02So.A=59(9) 99So20=47(10) **
*^{58}V T : average 03Ma02=185(10) 98Am04=200(20) 98So03=205(20) **
*^{58}Ni T : >400 Ey to 2^+ level of 58Fe, >700 Ey to ground-state **
*^{58}Zn T : average 02Lo13=83(10) 98Jo18=86(18) **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{59}Sc	−10040#	900#			10#	ms		$7/2^-$#				β^- ?; β^-n ?	
^{59}Ti	−25220#	700#			30	ms	3	$5/2^-$#	02	02So.A	T	β^-=100	*
^{59}V	−37070	310			75	ms	7	$7/2^-$#	02			β^-=100; β^-n ?	
^{59}Cr	−47890	240			460	ms	50	$5/2^-$#	02			β^-=100	
^{59}Cr^m	−47390	240	503.0	1.7	96	μs	20	$(9/2^+)$	02			IT=100	
^{59}Mn	−55480	30			4.59	s	0.05	$(5/2)^-$	02			β^-=100	
^{59}Fe	−60663.1	0.7			44.495	d	0.009	$3/2^-$	02			β^-=100	
^{59}Co	−62228.4	0.6			STABLE			$7/2^-$	02			IS=100.	
^{59}Ni	−61155.7	0.6			101	ky	13	$3/2^-$	02	94Ru19	T	β^+=100	*
^{59}Cu	−56357.2	0.8			81.5	s	0.5	$3/2^-$	02			β^+=100	
^{59}Zn	−47260	40			182.0	ms	1.8	$3/2^-$	02			β^+=100; β^+p=0.10 3	
^{59}Ga	−34120#	170#						$3/2^-$#				p ?	
^{59}Ge	−17000#	280#						$7/2^-$#				2p ?	
*^{59}Ti	T : supersedes 99So20=58(17) same group												**
*^{59}Ni	T : unweighed average 94Ru19=108(13) 94Ru19(meteorite)=120(22) 81Ni08=76(5)												**
*^{59}Ni	T : (Birge ratio B=2.05)												**
^{60}Sc	−4000#	900#			3#	ms		3^+#				β^- ?	
^{60}Ti	−21650#	800#			22	ms	2	0^+		02So.A	TD	β^-=100	
^{60}V	−32580	470			122	ms	18	3^+#	97	99So20	TD	β^-=100; β^-n ?	*
^{60}V^m	−32580#	490#	0#	150#	40	ms	15	1^+#		03So02	TD	β^-=?; IT ?	
^{60}V^n	−32480	470	101	1			(>400 ns)			99So20	EI	IT=100	
^{60}Cr	−46500	210			560	ms	60	0^+	93	96Do23	T	β^-=100	*
^{60}Mn	−53180	90			51	s	6	0^+	94			β^-=100	
^{60}Mn^m	−52910	90	271.90	0.10	1.77	s	0.02	3^+	94	92Sc.A	E	β^-=88.5 8; IT=11.5 8	
^{60}Fe	−61412	3			1.5	My	0.3	0^+	93			β^-=100	
^{60}Co	−61649.0	0.6			5.2713	y	0.0008	5^+	00			β^-=100	
^{60}Co^m	−61590.4	0.6	58.59	0.01	10.467	m	0.006	2^+	00			IT≈100; β^-=0.24 3	
^{60}Ni	−64472.1	0.6			STABLE			0^+	96			IS=26.2231 77	
^{60}Cu	−58344.1	1.7			23.7	m	0.4	2^+	93			β^+=100	
^{60}Zn	−54188	11			2.38	m	0.05	0^+	02			β^+=100	
^{60}Ga	−40000#	110#			70	ms	10	(2^+)	02	01Ma96	TJ	β^+=100; β^+p=1.6 7; ...	*
^{60}Ge	−27770#	230#			30#	ms		0^+				β^+ ?	
^{60}As	−6400#	600#						5^+#				p ?	
^{60}As^m	−6340#	600#	60#	20#				2^+#				p ?	
*^{60}V	T : also 98Am04=200(40), not used												**
*^{60}Cr	T : weighed average 96Do23=510(150) 88Bo06=570(60); other 95Am.A=380(30)												**
*^{60}Ga	D : ... ; $\beta^+\alpha$<0.023 20												**
*^{60}Ga	T : average 02Lo13=70(13) 01Ma96=70(15)												**
^{61}Ti	−15650#	900#			10#	ms	(>300 ns)	$1/2^-$#	99	97Be70	I	β^- ?; β^-n ?	
^{61}V	−29360#	400#			47.0	ms	1.2	$7/2^-$#	99	03So02	TD	β^-=100; β^-n<6	
^{61}Cr	−42180	250			261	ms	15	$5/2^-$#	99	99So20	TD	β^-=100; β^-n ?	*
^{61}Mn	−51560	230			670	ms	40	$(5/2)^-$	99	99Ha05	D	β^-=100; β^-n=?	
^{61}Fe	−58921	20			5.98	m	0.06	$3/2^-,5/2^-$	99			β^-=100	
^{61}Fe^m	−58060	20	861	3	250	ns	10	$9/2^+$#	99	98Gr14	E	IT=100	
^{61}Co	−62898.4	0.9			1.650	h	0.005	$7/2^-$	99			β^-=100	
^{61}Ni	−64220.9	0.6			STABLE			$3/2^-$	99			IS=1.1399 6	
^{61}Cu	−61983.6	1.0			3.333	h	0.005	$3/2^-$	99			β^+=100	
^{61}Zn	−56345	16			89.1	s	0.2	$3/2^-$	99			β^+=100	
^{61}Zn^m	−56257	16	88.4	0.1	< 430	ms		$1/2^-$	99			IT=100	
^{61}Zn^n	−55927	16	418.10	0.15	140	ms	70	$3/2^-$	99			IT=100	
^{61}Zn^p	−55589	16	756.02	0.18	< 130	ms		$5/2^-$	99			IT=100	
^{61}Ga	−47090	50			168	ms	3	$3/2^-$	99	02We07	TD	β^+=100; β^+p≈0	
^{61}Ga^m	−47000#	110#	90#	100#				$1/2^-$#					
^{61}Ge	−33730#	300#			39	ms	12	$3/2^-$#	99	02Lo13	T	β^+=100; β^+p≈80	*
^{61}As	−18050#	600#						$3/2^-$#				p ?	
*^{61}Cr	T : average 99So20=251(22) 98Am04=270(20)												**
*^{61}Ge	T : average 02Lo13=36(21) 87Ho01=40(15)												**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{62}Ti	−11650#	900#				10#	ms		0^{+}				β^{-} ?	
^{62}V	−24420#	500#				33.5	ms	2.0	3^{+}#	01	03So02	TD	β^{-}=100	
^{62}Cr	−40410	340				199	ms	9	0^{+}	01	02So.A	TD	β^{-}=100; β^{-}n ?	*
^{62}Mn	−48040	220			*	671	ms	5	(3^{+})	01	99Ha05	TD	β^{-}=100; β^{-}n=?	
^{62}Mn^{m}	−48040#	270#	0#	150#	*	92	ms	13	(1^{+})		99So20	TJD	β^{-}=100; β^{-}n≈0	
^{62}Fe	−58901	14				68	s	2	0^{+}	01			β^{-}=100	
^{62}Co	−61432	20				1.50	m	0.04	2^{+}	01			β^{-}=100	
^{62}Co^{m}	−61410	21	22	5		13.91	m	0.05	5^{+}	01			β^{-}>99; IT<1	
^{62}Ni	−66746.1	0.6				STABLE			0^{+}	01			IS=3.6345 17	
^{62}Cu	−62798	4				9.673	m	0.008	1^{+}	01	02Un02	T	β^{+}=100	*
^{62}Zn	−61171	10				9.186	h	0.013	0^{+}	01			β^{+}=100	
^{62}Ga	−52000	28				115.99	ms	0.17	0^{+}	01	03Hy02	T	β^{+}=100	*
^{62}Ga^{m}	−51183	28	817.5	0.5		4.6	ns	0.5	(3^{+})	01	98Vi06	ETJ	IT=100	
^{62}Ge	−42240#	140#				130	ms	40	0^{+}	01	02Lo13	TD	β^{+}=100	*
^{62}As	−24960#	300#							1^{+}#	01			p ?	*

*^{62}Cr T : average 02So.A=209(12) 99So20=187(15) 98Am04=190(30) **
*^{62}Cu T : others 97Zi06(LS method)=9.68(0.04) 97Zi06(IC method)=9.673(0.026) **
*^{62}Cu T : 69Jo07=9.73(0.02) 69Bo11=9.7(0.1) 65Li11=9.79(0.06) 65Eb01=9.76(0.02) **
*^{62}Ga T : average 03Hy02=115.84(0.25) 79Da04=116.34(0.35) 78Al23=115.95(0.30) **
*^{62}Ge I : T=113(+6–5) ms in 93Wi03 (table 1) is a misprint for ^{62}Ga **
*^{62}As D : p-unstable from estimated S_p=–1476#(422#) keV **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{63}Ti	−5200#	1000#				3#	ms		$1/2^{-}$#				β^{-} ?; β^{-}n ?	
^{63}V	−20910#	600#				17	ms	3	$7/2^{-}$#	01	03So02	TD	β^{-}=100; β^{-}n<35	
^{63}Cr	−35530#	300#				129	ms	2	$1/2^{-}$#	01	02So.A	TD	β^{-}=100; β^{-}n ?	*
^{63}Mn	−46350	260				275	ms	4	$5/2^{-}$#	01	99Ha05	TD	β^{-}=100; β^{-}n=?	*
^{63}Fe	−55550	170				6.1	s	0.6	$(5/2)^{-}$	01			β^{-}=100	
^{63}Co	−61840	20				26.9	s	0.4	$7/2^{-}$	01	94It.A	T	β^{-}=100	*
^{63}Ni	−65512.6	0.6				100.1	y	2.0	$1/2^{-}$	01			β^{-}=100	
^{63}Ni^{m}	−65425.5	0.6	87.15	0.11		1.67	μs	0.03	$5/2^{-}$	01			IT=100	
^{63}Cu	−65579.5	0.6				STABLE			$3/2^{-}$	01			IS=69.17 3	
^{63}Zn	−62213.0	1.6				38.47	m	0.05	$3/2^{-}$	01			β^{+}=100	
^{63}Ga	−56547.1	1.3				32.4	s	0.5	$(3/2^{-})$	01			β^{+}=100	
^{63}Ge	−46910#	200#				142	ms	8	$3/2^{-}$#	01	02Lo13	TD	β^{+}=100	*
^{63}As	−33820#	500#							$3/2^{-}$#	01			p ?	*

*^{63}Cr T : also 99So20=113(16) and 98Am04=110(70) outweighed, not used **
*^{63}Mn T : also 99So20=322(23) 95Am.A=290(20) 85Bo49=250(40) outweighed, not used **
*^{63}Co T : average 94It.A=26.41(0.27) 72Jo08=27.5(0.3) 69Wa15=26(1) **
*^{63}Ge T : average 02Lo13=150(9) 93Wi03=95(+23–20) **
*^{63}As D : p-unstable from estimated S_p=–1132#(522#) keV **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{64}V	−15400#	700#				10#	ms	(>300 ns)		97	97Be70	I	β^{-} ?	
^{64}Cr	−33150#	400#				43	ms	1	0^{+}		02So.A	TD	β^{-}=100	*
^{64}Mn	−42620	270				88.8	ms	2.5	(1^{+})	96	99So20	TJD	β^{-}=100; β^{-}n=?	*
^{64}Mn^{m}	−42490	270	135	3		> 100	μs				98Gr14	ET	IT=100	
^{64}Fe	−54770	280				2.0	s	0.2	0^{+}	96			β^{-}=100	
^{64}Co	−59793	20				300	ms	30	1^{+}	96			β^{-}=100	
^{64}Ni	−67099.3	0.6				STABLE			0^{+}	96			IS=0.9256 9	
^{64}Cu	−65424.2	0.6				12.700	h	0.002	1^{+}	96			β^{+}=61.0 3; β^{-}=39.0 3	
^{64}Zn	−66003.6	0.7				STABLE		(>2.3 Ey)	0^{+}	96	85No03	T	IS=48.63 60; $2\beta^{+}$?	
^{64}Ga	−58834.3	2.0				2.627	m	0.012	$0^{(+\#)}$	96			β^{+}=100	
^{64}Ga^{m}	−58791.5	2.0	42.85	0.08		21.9	μs	0.7	2^{+}	96	99Ta29	TJ	IT=100	
^{64}Ge	−54350	30				63.7	s	2.5	0^{+}	96			β^{+}=100	
^{64}As	−39520#	360#				40	ms	30	0^{+}#		02Lo13	TD	β^{+}=100	

*^{64}Cr T : also 99So20=44(12) outweighed, not used **
*^{64}Mn T : average 02So.A=91(4) 99So20=85(5) 99Ha05=89(4); 98Am04=140(30) not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{65}V	−11250#	800#			10#	ms		$5/2^{-}$#				β^{-} ?; β^{-}n ?	
^{65}Cr	−27800#	500#			27	ms	3	$1/2^{-}$#	97	02So.A	TD	β^{-}=100; β^{-}n ?	
^{65}Mn	−40670	540			92	ms	1	$5/2^{-}$#	93	02So.A	TD	β^{-}=100; β^{-}n=?	*
^{65}Fe	−50880	240			1.3	s	0.3	$1/2^{-}$#	93	99So20	T	β^{-}=100	*
^{65}Fe^{m}	−50520	240	364	3	430	ns	130	$(5/2^{-})$		98Gr14	ETJ	IT=100	
^{65}Co	−59170	13			1.20	s	0.06	$(7/2)^{-}$	93			β^{-}=100	
^{65}Ni	−65126.1	0.6			2.5172	h	0.0003	$5/2^{-}$	97			β^{-}=100	
^{65}Ni^{m}	−64113.1	1.2	1013	1	26.7	ns	1.0	$9/2^{+}$		95Bl01	ETJ		
^{65}Cu	−67263.7	0.7			STABLE			$3/2^{-}$	93			IS=30.83 3	
^{65}Zn	−65911.6	0.7			244.06	d	0.10	$5/2^{-}$	00			β^{+}=100	
^{65}Zn^{m}	−65857.7	0.7	53.928	0.010	1.6	μs	0.6	$(1/2)^{-}$	00			IT=100	
^{65}Ga	−62657.2	0.8			15.2	m	0.2	$3/2^{-}$	93			β^{+}=100	
^{65}Ge	−56410	100			30.9	s	0.5	$(3/2)^{-}$	93	87Vi01	D	β^{+}=100; β^{+}p=0.011 3	
^{65}As	−46980#	300#			170	ms	30	$3/2^{-}$#	93	02Lo13	T	β^{+}=100	*
^{65}Se	−32920#	600#			< 50	ms		$3/2^{-}$#	93	94Mo.A	T	β^{+}=100; β^{+}p=?	*
*^{65}Mn	T : others 99Ha05=88(4) 99So20=100(8) 98Am04=110(20) outweighed, not used												**
*^{65}Fe	T : 95Am.A=760(50) ms supersedes 94Cz02=450(150) from same group, none used												**
*^{65}As	T : average 02Lo13=126(16) 95Mo26=190(11) with Birge ratio B=3.3												**
*^{65}Se	D : from 93Ba12												**
^{66}Cr	−24800#	600#			10	ms	6	0^{+}	98	02So.A	TD	β^{-}=100	
^{66}Mn	−36250#	400#			64.4	ms	1.8		98	02So.A	TD	β^{-}=100; β^{-}n=?	*
^{66}Fe	−49570	300			440	ms	40	0^{+}	98	99So20	TD	β^{-}=100; β^{-}n ?	*
^{66}Co	−56110	250			194	ms	17	(3^{+})	98	00Mu10	TJ	β^{-}=100	*
^{66}Co^{m}	−55940	250	175	3	1.21	μs	0.01	(5^{+})		98Gr14	ETJ	IT=100	
^{66}Co^{n}	−55470	250	642	5	> 100	μs		(8^{-})		98Gr14	ETJ	IT=100	
^{66}Ni	−66006.3	1.4			54.6	h	0.4	0^{+}	98			β^{-}=100	
^{66}Cu	−66258.3	0.7			5.120	m	0.014	1^{+}	98			β^{-}=100	
^{66}Zn	−68899.4	0.9			STABLE			0^{+}	98			IS=27.90 27	
^{66}Ga	−63724	3			9.49	h	0.07	0^{+}	98			β^{+}=100	
^{66}Ge	−61620	30			2.26	h	0.05	0^{+}	98			β^{+}=100	
^{66}As	−51500	680			95.77	ms	0.23	(0^{+})	98	98Gr12	J	β^{+}=100	
^{66}As^{m}	−50140	680	1356.70	0.17	1.1	μs	0.1	(5^{+})		01Gr07	TJ	IT=100	*
^{66}As^{n}	−48480	680	3023.9	0.3	8.2	μs	0.5	(9^{+})		01Gr07	TJ	IT=100	*
^{66}Se	−41720#	300#			33	ms	12	0^{+}	98	02Lo13	TD	β^{+}=100	
*^{66}Mn	T : average 02So.A=64(2) 99Ha05=66(4)												**
*^{66}Mn	T : also 99So20=62(14) 98Am04=90(20) outweighed, not used												**
*^{66}Fe	T : average 99So20=440(60) 98Am04=440(60)												**
*^{66}Co	T : average 00Mu10=180(10) 94Cz02=240(30) 85Bo49=230(20)												**
*^{66}As^{m}	J : 3^{+}# from systematics												**
*^{66}As^{n}	T : supersedes 98Gr12=17.5(1.5) E : from 98Gr12												**
^{67}Cr	−19050#	700#			10#	ms	(>300 ns)	$1/2^{-}$#		97Be70	I	β^{-} ?	
^{67}Mn	−33400#	500#			45	ms	3	$5/2^{-}$#	97	02So.A	TD	β^{-}=100; β^{-}n=?	*
^{67}Fe	−45690	420			394	ms	9	$1/2^{-}$#	91	02So.A	TD	β^{-}=100; β^{-}n ?	*
^{67}Fe^{m}	−45320	420	367	3	64	μs	17	$(5/2^{-})$		03Sa02	ET	IT=100	*
^{67}Co	−55060	320			425	ms	20	$7/2^{-}$#	91	99We07	T	β^{-}=100	*
^{67}Ni	−63742.7	2.9			21	s	1	$1/2^{-}$	01	00Ri14	J	β^{-}=100	
^{67}Ni^{m}	−62736	4	1007	3	13.3	μs	0.2	$9/2^{+}$	01	98Gr14	E	IT=100	
^{67}Cu	−67318.8	1.2			61.83	h	0.12	$3/2^{-}$	91			β^{-}=100	
^{67}Zn	−67880.4	0.9			STABLE			$5/2^{-}$	91			IS=4.10 13	
^{67}Ga	−66879.7	1.3			3.2612	d	0.0006	$3/2^{-}$	96			ε=100	
^{67}Ge	−62658	5			18.9	m	0.3	$1/2^{-}$	91			β^{+}=100	
^{67}Ge^{m}	−62640	5	18.2	0.05	13.7	μs	0.9	$5/2^{-}$	91			IT=100	
^{67}Ge^{n}	−61906	5	751.70	0.06	110.9	ns	1.4		91			IT=100	
^{67}As	−56650	100			42.5	s	1.2	$(5/2^{-})$	91			β^{+}=100	

. . . A-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
... *A*-group continued ...														
^{67}Se	−46490#	200#				133	ms	11	5/2−#	97	95Bl23	TD	β^+=100; β^+p=0.5 1	∗
^{67}Br	−32800#	500#							1/2−#				p ?	
∗^{67}Mn	T : average 02So.A=47(4) 99Ha05=42(4)													∗∗
∗^{67}Fe	T : others 99So20=500(100) 98Am04=470(50) outweighed, not used													∗∗
∗^{67}Fe^m	T : average 03Sa02=75(21) 98Gr14=43(30), same authors, different experiment													∗∗
∗^{67}Co	T : others 99Pr10=440(70) 99So20=440(80) 85Bo49=420(70) outweighed, not used													∗∗
∗^{67}Co	T : and 95Am.A=310(20) at variance, not used													∗∗
∗^{67}Se	T : average 02Lo13=136(12) 94Ba50=107(35)													∗∗
∗^{67}Se	T : values from 95Bl23 for ^{67}Se=60(+17–11) and ^{71}Kr questioned by 97Oi01													∗∗
^{68}Mn	−28600#	600#				28	ms	4		02	02So.A	T	β^-=100; β^-n=?	∗
^{68}Fe	−43130	700				187	ms	6	0+	02	02So.A	T	β^-=100; β^-n ?	∗
^{68}Co	−51350	320			∗	200	ms	21	(7−)	02	00Mu10	T	β^-=100	∗
^{68}Co^m	−51200#	350#	150#	150#	∗	1.6	s	0.3	(3+)	02	00Mu10	JD	β^-=?; IT ?	
^{68}Ni	−63463.8	3.0				29	s	2	0+	02			β^-=100	
^{68}Ni^m	−61694	3	1770.0	1.0		276	ns	65	0+	02			IT=100	
^{68}Ni^n	−60615	3	2849.1	0.3		860	μs	50	5−	02			IT=100	
^{68}Cu	−65567.0	1.6				31.1	s	1.5	1+	02			β^-=100	
^{68}Cu^m	−64845.4	1.7	721.6	0.7		3.75	m	0.05	(6−)	02			IT=84 1; β^-=16 1	
^{68}Zn	−70007.2	1.0				STABLE			0+	02			IS=18.75 51	
^{68}Ga	−67086.1	1.5				67.71	m	0.09	1+	02			β^+=100	
^{68}Ga^m	−65856.2	1.5	1229.87	0.04		62.0	ns	1.4	7−	02			IT=100	
^{68}Ge	−66980	6				270.95	d	0.16	0+	02			ε=100	
^{68}As	−58900	40				151.6	s	0.8	3+	02			β^+=100	
^{68}As^m	−58470	40	425.21	0.16		111	s	20	1+	02			IT=100	
^{68}Se	−54210	30				35.5	s	0.7	0+	02			β^+=100	
^{68}Br	−38640#	360#				< 1.5	μs		3+#	02	95Bl06	I	p ?	
∗^{68}Mn	T : average 02So.A=28(8) 99Ha05=28(4)													∗∗
∗^{68}Fe	T : others 99So20=155(50) 91Be33=100(60) outweighed, not used													∗∗
∗^{68}Co	T : average 00Mu10=230(30) 99So20=170(30); not used 95Am.A=310(30)													∗∗
∗^{68}Co	T : 95Am.A supersedes 91Be33=180(100) from same group													∗∗
^{69}Mn	−25300#	800#				14	ms	4	5/2−#	00			β^-=100; β^-n=24#	∗
^{69}Fe	−38400#	500#				109	ms	9	1/2−#	00	02So.A	T	β^-=100; β^-n=7#	
^{69}Co	−50000	340				227	ms	13	7/2−#	00	02So.A	T	β^-=100; β^-n=1#	∗
^{69}Ni	−59979	4				11.5	s	0.3	9/2+	00	99Pr10	T	β^-=100	∗
^{69}Ni^m	−59658	4	321	2		3.5	s	0.4	(1/2−)	00	98Gr14	E	$\beta^-\approx$100; IT ?	∗
^{69}Ni^n	−57278	11	2701	10		439	ns	3	(17/2−)	00			IT=100	
^{69}Cu	−65736.2	1.4				2.85	m	0.15	3/2−	00			β^-=100	
^{69}Cu^m	−62994.4	1.7	2741.8	1.0		360	ns	30	(13/2+)	00			IT=100	
^{69}Zn	−68418.0	1.0				56.4	m	0.9	1/2−	00			β^-=100	
^{69}Zn^m	−67979.4	1.0	438.636	0.018		13.76	h	0.02	9/2+	00			IT$\approx$100; β^-=0.033 3	
^{69}Ga	−69327.8	1.2				STABLE			3/2−	00			IS=60.108 9	
^{69}Ge	−67100.6	1.3				39.05	h	0.10	5/2−	00			β^+=100	
^{69}Ge^m	−67013.8	1.3	86.765	0.014		5.1	μs	0.2	1/2−	00			IT=100	
^{69}Ge^n	−66702.7	1.3	397.944	0.018		2.81	μs	0.05	9/2+	00			IT=100	
^{69}As	−63090	30				15.2	m	0.2	5/2−	00			β^+=100	
^{69}Se	−56300	30				27.4	s	0.2	(1/2−)	00	95Po01	J	β^+=100; β^+p=0.045 10	
^{69}Se^m	−56260	30	39.4	0.1		2.0	μs	0.2	5/2−	00			IT=100	
^{69}Se^n	−55730	30	573.9	1.0		955	ns	16	9/2+	00	00Ch07	T	IT=100	∗
^{69}Br	−46480#	110#			∗	< 24	ns		1/2−#	00	96Pf01	I	p ?	∗
^{69}Br^m	−46440#	150#	40#	100#	∗				5/2−#					
^{69}Br^n	−45910#	150#	570#	100#					9/2+#					

... *A*-group is continued on next page ...

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .															
^{69}Kr	−32440#	400#					32	ms	10	$5/2^-$#	00			β^+=100; β^+p=?	

*^{69}Mn D : β^-n observed by 99Ha05 **
*^{69}Co T : average 02So.A=232(17) 99Mu17=220(20); other 99So20=190(40), not used **
*^{69}Ni T : average 99Pr10=11.7(0.6) 85Bo49=11.4(0.3); not used 98Fr15=11.2(0.9) **
*^{69}Ni^m T : average 99Mu17=3.5(0.5) 99Pr10=3.4(0.7) **
*^{69}Ni^m E : 9/2$^+$ level in isotones: ^{73}Ge=–66 ^{71}Zn=157(1) 69Ni=–321(2) exhibits **
*^{69}Ni^m E : unusual strong variations **
*^{69}Se^n T : average 00Ch07=950(21) 95Po01=960(23) **
*^{69}Br T : in contradiction with 450 keV protons, 50<T<100 μs reported in 88Ho.A **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{70}Fe	−35900#	600#					94	ms	17	0^+	97	02So.A	TD	β^-=100	
^{70}Co	−45640	840				*	125	ms	7	$(6^-,7^-)$	93	00Mu10	TJD	β^-=100; β^-n ?	*
^{70}Co^m	−45440#	860#	200#	200#		*	500	ms	180	(3^+)		00Mu10	TJD	$\beta^-\approx$100; IT ?; β^-n ?	
^{70}Ni	−59150	350					6.0	s	0.3	0^+	03	98Fr15	TD	β^-=100	
^{70}Ni^m	−56290	350	2860	2			232	ns	1	8^+	03			IT=100	
^{70}Cu	−62976.1	1.6				&	44.5	s	0.2	(6^-)	93	02We03	TJ	β^-=100	
^{70}Cu^m	−62875.4	2.0	100.7	2.6	MD		33	s	2	(3^-)		02We03	TJ	$\beta^-\approx$50; IT$\approx$50	
^{70}Cu^n	−62734.1	2.1	242.0	2.7	MD	&	6.6	s	0.2	1^+	93	02We03	TD	$\beta^-\approx$95; IT$\approx$5	*
^{70}Zn	−69564.6	2.0					STABLE			0^+	93			IS=0.62 3; 2β^- ?	*
^{70}Ga	−68910.1	1.2					21.14	m	0.03	1^+	93			$\beta^-\approx$100; ε=0.41 6	
^{70}Ge	−70563.1	1.0					STABLE			0^+	93			IS=20.84 87	
^{70}As	−64340	50					52.6	m	0.3	$4^{(+\#)}$	93			β^+=100	
^{70}As^m	−64310	50	32.06	0.03			96	μs	3	$2^{(+)}$	93			IT=100	
^{70}Se	−62050	60					41.1	m	0.3	0^+	93			β^+=100	
^{70}Br	−51430#	310#					79.1	ms	0.8	0^+#	93			β^+=100	
^{70}Br^m	−49140#	310#	2292.2	0.8			2.2	s	0.2	(9^+)	93	00Pi15	J	β^+=?; IT ?	*
^{70}Kr	−41680#	390#					57	ms	21	0^+	97	00Oi02	TD	β^+ ?	

*^{70}Co T : average 02So.A=121(8) 98Am04=150(20); others 00Mu10=120(30) 99So20=92(25) **
*^{70}Cu^n D : IT=few percent E : post deadline 03Va.2 101.1(0.3) and 242.4(0.3) **
*^{70}Zn T : >500 Ty in ENSDF is for 0ν-2β^- decay alone **
*^{70}Br^m E : from 2002Je07 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{71}Fe	−31000#	800#					30#	ms (>300 ns)		$7/2^+$#	97	97Be70	I	β^- ?	
^{71}Co	−43870	840					97	ms	2	$7/2^-$#	93	02So.A	T	β^-=100; β^-n ?	*
^{71}Ni	−55200	370					2.56	s	0.03	$1/2^-$#	93	98Fr15	T	β^-=100	
^{71}Cu	−62711.1	1.5					19.4	s	1.4	$(3/2^-)$	93	99Pr10	T	β^-=100	*
^{71}Cu^m	−59955	10	2756	10			271	ns	13	$(19/2^-)$		98Gr14	ETJ	IT=100	*
^{71}Zn	−67327	10					2.45	m	0.10	$1/2^-$	93			β^-=100	
^{71}Zn^m	−67169	10	157.7	1.3			3.96	h	0.05	$9/2^+$	93			$\beta^-\approx$100; IT$\leq$0.05	
^{71}Ga	−70140.2	1.0					STABLE			$3/2^-$	93			IS=39.892 9	
^{71}Ge	−69907.7	1.0					11.43	d	0.03	$1/2^-$	93			ε=100	
^{71}Ge^m	−69709.3	1.0	198.367	0.010			20.40	ms	0.17	$9/2^+$	93			IT=100	
^{71}As	−67894	4					65.28	h	0.15	$5/2^-$	93			β^+=100	
^{71}Se	−63120	30					4.74	m	0.05	$5/2^-$	93			β^+=100	
^{71}Se^m	−63070	30	48.79	0.05			5.6	μs	0.7	$1/2^- to 9/2^-$	93			IT=100	
^{71}Se^n	−62860	30	260.48	0.10			19.0	μs	0.5	$(9/2)^+$	93	00Ch07	T	IT=100	
^{71}Br	−57060	570					21.4	s	0.6	$(5/2)^-$	93			β^+=100	
^{71}Kr	−46920	650					100	ms	3	$(5/2)^-$	97	97Oi01	TJD	β^+=100; β^+p=2.1 7	*
^{71}Rb	−32300#	500#				*				$5/2^-$#				p ?	
^{71}Rb^m	−32250#	510#	50#	100#		*				$1/2^-$#					
^{71}Rb^n	−32040#	510#	260#	100#						$9/2^+$#					

*^{71}Co T : other not used: 98Am04=210(40) **
*^{71}Cu T : average 99Pr10=19(3) 83Ru06=19.5(1.6) **
*^{71}Cu^m T : average 98Is11=250(30) 98Gr14=275(14) **
*^{71}Kr T : average 97Oi01=100(3) 81Ew01=97(9); 95Bl23=64(+8–5) at variance not used **
*^{71}Kr T : values from 95Bl23 for ^{67}Se and ^{71}Kr questioned by 97Oi01 **
*^{71}Kr D : 95Bl23=5.2(0.6) at variance not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{72}Fe	−28300#	800#					10#	ms	(>300 ns)	0^+	97	97Be70	I	β^- ?	
^{72}Co	−39300#	600#					90	ms	20			98Am04	TD	β^-=100; β^-n ?	
^{72}Ni	−53940	440					1.57	s	0.05	0^+		98Fr15	TD	β^-=100; β^-n ?	*
^{72}Cu	−59783.0	1.4					6.6	s	0.1	(1^+)	95			β^-=100	
^{72}Cu^m	−59513	3	270	3			1.76	μs	0.03	(4^-)		98Gr14	ETJ	IT=100	
^{72}Zn	−68131	6					46.5	h	0.1	0^+	95			β^-=100	
^{72}Ga	−68589.4	1.0					14.10	h	0.02	3^-	95			β^-=100	
^{72}Ga^m	−68469.7	1.0	119.66	0.05			39.68	ms	0.13	(0^+)	95			IT=100	
^{72}Ge	−72585.9	1.6					STABLE			0^+	95			IS=27.54 34	
^{72}Ge^m	−71894.5	1.6	691.43	0.04			444.2	ns	0.8	0^+					
^{72}As	−68230	4					26.0	h	0.1	2^-	95			β^+=100	
^{72}Se	−67894	12					8.40	d	0.08	0^+	97			ε=100	
^{72}Br	−59020	60					78.6	s	2.4	1^+	95	03Pi03	J	β^+=100	
^{72}Br^m	−58920	60	100.92	0.03			10.6	s	0.3	1^-	95			IT≈100; β^+=?	
^{72}Kr	−53941	8					17.16	s	0.18	0^+	95	03Pi03	T	β^+=100	*
^{72}Rb	−38120#	500#				*	< 1.5	μs		3^+#	97	95Bl06	I	p ?	
^{72}Rb^m	−38020#	510#	100#	100#		*	1#	μs		1^-#				p ?	
*^{72}Ni	T : not used 95Am.A=1.30(0.10) and 92Be.A=2.06(0.30) (the two of same group)														**
*^{72}Kr	T : average 03Pi03=17.1(0.2) 73Da22=17.4(0.4)														**
^{73}Co	−37040#	700#					80#	ms	(>300 ns)	$7/2^-$#	02	97Be70	I	β^- ?	
^{73}Ni	−49860#	300#					840	ms	30	$(9/2^+)$	02			β^-=100; β^-n ?	
^{73}Cu	−58987	4					4.2	s	0.3	$(3/2^-)$	02	98Fr15	J	β^-=100; β^-n ?	
^{73}Zn	−65410	40					23.5	s	1.0	$(1/2)^-$	02			β^-=100	
^{73}Zn^m	−65210	40	195.5	0.2			13.0	ms	0.2	$(5/2^+)$	02			IT=100	
^{73}Zn^n	−65170	40	237.6	2.0	EU		5.8	s	0.8	$(7/2^+)$	02			IT=?; β^-=?	*
^{73}Ga	−69699.3	1.7					4.86	h	0.03	$3/2^-$	02			β^-=100	
^{73}Ge	−71297.5	1.6					STABLE			$9/2^+$	02			IS=7.73 5	
^{73}Ge^m	−71284.2	1.6	13.2845	0.0015			2.92	μs	0.03	$5/2^+$	02			IT=100	
^{73}Ge^n	−71230.8	1.6	66.726	0.009			499	ms	11	$1/2^-$	02			IT=100	
^{73}As	−70957	4					80.30	d	0.06	$3/2^-$	93			ε=100	
^{73}Se	−68218	11					7.15	h	0.08	$9/2^+$	03			β^+=100	
^{73}Se^m	−68192	11	25.71	0.04			39.8	m	1.3	$3/2^-$	03			IT=72.6 3; β^+=27.4 3	
^{73}Br	−63630	50					3.4	m	0.2	$1/2^-$	02			β^+=100	
^{73}Kr	−56552	7					28.6	s	0.6	$3/2^-$	02	99Mi17	T	β^+=100; β^+p=0.25 3	*
^{73}Kr^m	−56118	7	433.66	0.12			107	ns	10	$(9/2^+)$	03			IT=100	
^{73}Rb	−46050#	150#					< 30	ns		$3/2^-$#	03	96Pf01	I	p ?	
^{73}Rb^m	−45620#	180#	430#	100#						$9/2^+$#					
^{73}Sr	−31700#	600#					> 25	ms		$1/2^-$#	03			β^+=100; β^+p=?	
*^{73}Zn^n	E : if 42.1 keV γ feeds ^{73}Zn^m, EU: see discussion in ENSDF'02														**
*^{73}Kr	T : average 99Mi17=29.0(1.0) 81Ha44=28.4(0.7); 73Da22=25.9(0.6) at variance,														**
*^{73}Kr	T : not used														**
^{74}Co	−32250#	800#					50#	ms	(>300 ns)		03	97Be70	I	β^- ?	
^{74}Ni	−48370#	400#					680	ms	120	0^+	03	98Fr15	T	β^-=100; β^-n ?	*
^{74}Cu	−56006	6					1.594	s	0.010	1^+#	95			β^-=100	
^{74}Zn	−65710	50					95.6	s	1.2	0^+	95			β^-=100	
^{74}Ga	−68050	4					8.12	m	0.12	(3^-)	95			β^-=100	
^{74}Ga^m	−67990	4	59.571	0.014			9.5	s	1.0	(0)	95			IT=?; β^-=25#	
^{74}Ge	−73422.4	1.6					STABLE			0^+	95			IS=36.28 73	
^{74}As	−70860.0	2.3					17.77	d	0.02	2^-	95			β^+=66 2; β^-=34 2	
^{74}Se	−72212.7	1.7					STABLE			0^+	95			IS=0.89 4; 2β^+ ?	
^{74}Br	−65306	15					25.4	m	0.3	(0^-)	95			β^+=100	
^{74}Br^m	−65292	15	13.58	0.21			46	m	2	$4^{(+\#)}$	95			β^+=100	
^{74}Kr	−62331.5	2.0					11.50	m	0.11	0^+	95			β^+=100	
^{74}Kr^m	−61824	10	508	10			29	ns	6	0^+		00Ch07	ETJ	IT=100	
^{74}Rb	−51917	4					64.76	ms	0.03	(0^+)	95	01Ba12	T	β^+=100	
^{74}Sr	−40700#	500#					50#	ms	(>1.5 μs)	0^+	97	95Bl06	I	β^+ ?	
*^{74}Ni	T : average 98Fr15=900(200) 98Am04=540(160)														**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{75}Co	−29500#	800#				40#	ms	(>300 ns)	$7/2^-$#	99	97Be70	I	β^- ?	
^{75}Ni	−43900#	400#				600	ms	200	$7/2^+$#	99	85Re01	D	β^-=100; β^-n=1.6#	∗
^{75}Cu	−54120	980				1.224	s	0.003	$3/2^-$#	99			β^-=100; β^-n=3.5 6	
^{75}Zn	−62470	70				10.2	s	0.2	$7/2^+$#	99			β^-=100	
^{75}Ga	−68464.6	2.4				126	s	2	$(3/2)^-$	99			β^-=100	
^{75}Ge	−71856.4	1.6				82.78	m	0.04	$1/2^-$	99			β^-=100	
^{75}Ge^m	−71716.7	1.6	139.69	0.03		47.7	s	0.5	$7/2^+$	99			IT≈100; β^-=0.030 6	
^{75}As	−73032.4	1.8				STABLE			$3/2^-$	99			IS=100.	
^{75}As^m	−72728.5	1.8	303.9241	0.0007		17.62	ms	0.23	$9/2^+$	99			IT=100	
^{75}Se	−72169.0	1.7				119.779	d	0.004	$5/2^+$	99			ε=100	
^{75}Br	−69139	14				96.7	m	1.3	$3/2^-$	99			β^+=100	
^{75}Kr	−64324	8				4.29	m	0.17	$5/2^+$	99			β^+=100	
^{75}Rb	−57222	7				19.0	s	1.2	$(3/2^-)$	99			β^+=100	
^{75}Sr	−46620	220				88	ms	3	$(3/2^-)$	99	03Hu01	TJD	β^+=100; β^+p=5.2 9	
∗^{75}Ni	D : β^-n=1.6%# estimated by 85Re01													∗∗
^{76}Ni	−41610#	900#				470	ms	390	0^+	97	98Am04	T	β^-=100; β^-n ?	
^{76}Cu	−50976	7			∗	641	ms	6	$(3,5)$	95	90Wi12	J	β^-=100; β^-n=3 2	
^{76}Cu^m	−50980#	200#	0#	200#	∗	1.27	s	0.30	$(1,3)$	95	90Wi12	J	β^-=100	
^{76}Zn	−62140	80				5.7	s	0.3	0^+	95			β^-=100	
^{76}Ga	−66296.6	2.0				32.6	s	0.6	$(2^+,3^+)$	95			β^-=100	
^{76}Ge	−73213.0	1.7				1.58	Zy	0.17	0^+	95	01Kl11	T	IS=7.61 38; 2β^-=100	∗
^{76}As	−72289.5	1.8				1.0778	d	0.0020	2^-	95			β^-≈100; ε<0.02	
^{76}As^m	−72245.1	1.8	44.425	0.001		1.84	μs	0.06	$(1)^+$					
^{76}Se	−75252.1	1.7				STABLE			0^+	95			IS=9.37 29	
^{76}Br	−70289	9				16.2	h	0.2	1^-	95			β^+=100	
^{76}Br^m	−70186	9	102.58	0.03		1.31	s	0.02	$(4)^+$	95			IT>99.4; β^+<0.6	
^{76}Kr	−69014	4				14.8	h	0.1	0^+	95			β^+=100	
^{76}Rb	−60479.8	1.9				36.5	s	0.6	$1^{(-)}$	95	78Ha08	D	β^+=100; $\beta^+\alpha$=3.8e–7 10	
^{76}Rb^m	−60162.9	1.9	316.93	0.08		3.050	μs	0.007	(4^+)	95	00Ch07	T	IT=100	
^{76}Sr	−54240	40				8.9	s	0.3	0^+	95			β^+=100	
^{76}Y	−38700#	500#				500#	ns	(>170 ns)			00We.A	I	β^+ ?; p ?	∗
∗^{76}Ge	T : from 01Kl11=1.55(+0.19–0.15); other results from same group:													∗∗
∗^{76}Ge	T : 97Gu13=1.77(+0.13–0.11) 94Ba15=1.42(0.13)													∗∗
∗^{76}Ge	T : other groups 93Br22=0.84(+0.10–0.08)(2σ) 90Va18=0.90(0.10)													∗∗
∗^{76}Ge	T : and 90Mi23=1.1(+0.6–0.3)(2σ)													∗∗
∗^{76}Ge	TD : claim for 0ν-$\beta\beta$ 01Kl13=15 Yy not trusted. See also 02Aa.1 and 02Zd02													∗∗
∗^{76}Y	I : also 01Ki13>200 ns, same group													∗∗
^{77}Ni	−36750#	500#				300#	ms	(>300 ns)	$9/2^+$#	97	97Be70	I	β^- ?	
^{77}Cu	−48580#	400#				469	ms	8	$3/2^-$#	97			β^-=100	
^{77}Zn	−58720	120				2.08	s	0.05	$7/2^+$#	97			β^-=100	
^{77}Zn^m	−57950	120	772.39	0.12		1.05	s	0.10	$1/2^-$#	97			IT>50; β^-<50	
^{77}Ga	−65992.3	2.4				13.2	s	0.2	$(3/2^-)$	97			β^-=100	
^{77}Ge	−71214.0	1.7				11.30	h	0.01	$7/2^+$	97			β^-=100	
^{77}Ge^m	−71054.3	1.7	159.70	0.10		52.9	s	0.6	$1/2^-$	97			β^-=81 2; IT=19 2	
^{77}As	−73916.6	2.3				38.83	h	0.05	$3/2^-$	97			β^-=100	
^{77}As^m	−73441.2	2.3	475.443	0.016		114.0	μs	2.5	$9/2^+$	97			IT=100	
^{77}Se	−74599.6	1.7				STABLE			$1/2^-$	97			IS=7.63 16	
^{77}Se^m	−74437.7	1.7	161.9223	0.0007		17.36	s	0.05	$7/2^+$	97			IT=100	
^{77}Br	−73235	3				57.036	h	0.006	$3/2^-$	97			β^+=100	
^{77}Br^m	−73129	3	105.86	0.08		4.28	m	0.10	$9/2^+$	97			IT=100	
^{77}Kr	−70169.4	2.0				74.4	m	0.6	$5/2^+$	97			β^+=100	
^{77}Rb	−64825	7				3.77	m	0.04	$3/2^-$	97			β^+=100	
^{77}Sr	−57804	9				9.0	s	0.2	$5/2^+$	97			β^+=100; β^+p<0.25	
^{77}Y	−46910#	60#				63	ms	17	$5/2^+$#	97	01Ki13	T	β^+=?; β^+p ?; p<10	∗
∗^{77}Y	D : limit for p is from 00We.A													∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{78}Ni	−34300#	1100#				200#	ms	(>300 ns)	0^+	97	97Be70	I	β^- ?	
^{78}Cu	−44750#	400#				342	ms	11		97	91Kr15	T	β^-=100	
^{78}Zn	−57340	90				1.47	s	0.15	0^+	91			β^-=100	
^{78}Zn^m	−54670	90	2673	1		319	ns	9	(8^+)		00Da07	ET	IT=100	
^{78}Ga	−63706.6	2.4				5.09	s	0.05	(3^+)	91			β^-=100	
^{78}Ge	−71862	4				88	m	1	0^+	91			β^-=100	
^{78}As	−72817	10				90.7	m	0.2	2^-	91			β^-=100	
^{78}Se	−77026.1	1.7				STABLE			0^+	91			IS=23.77 28	
^{78}Br	−73452	4				6.46	m	0.04	1^+	91			$\beta^+\approx$100; β^-<0.01	*
^{78}Br^m	−73271	4	180.82	0.13		119.2	μs		4^+					
^{78}Kr	−74179.7	1.1				STABLE		(>110 Ey)	0^+	91	94Sa31	T	IS=0.35 1; 2β^+ ?	*
^{78}Rb	−66936	7				17.66	m	0.08	$0^{(+)}$	91			β^+=100	
^{78}Rb^m	−66825	7	111.20	0.10		5.74	m	0.05	$4^{(-)}$	91	91Mc.A	E	β^+=90 2; IT=10 2	
^{78}Rb^x	−66862	14	74	12		R = 2.0 0.5			spmix					
^{78}Sr	−63174	7				159	s	8	0^+	91	92Gr09	T	β^+=100	
^{78}Y	−52530#	400#			*	54	ms	5	(0^+)	97	01Ga24	TJD	β^+=100; β^+p ?	*
^{78}Y^m	−52530#	640#	0#	500#	*	5.8	s	0.5	5^+#		01Ki13	TD	β^+=100; β^+p ?	*
^{78}Zr	−41700#	500#				50#	ms	(>170 ns)	0^+		00We.A	I	β^+ ?; β^+p ?	*

*^{78}Br D : β^- branch is uncertain. See ENSDF **
*^{78}Kr T : limit given here is for the K-e$^+$ decay (theoretically faster) **
*^{78}Y T : average 01Ga24=50(8) 01Ki13=55(+9–6) **
*^{78}Y^m T : average 01Ki13=5.7(0.7) 98Uu01=5.8(0.6) **
*^{78}Zr I : also 01Ki13>200 ns same group **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{79}Cu	−42330#	500#				188	ms	25	$3/2^-$#	02			β^-=100; β^-n=55 17	
^{79}Zn	−53420#	260#				995	ms	19	$(9/2^+)$	02			β^-=100; β^-n=1.3 4	
^{79}Ga	−62510	100				2.847	s	0.003	$3/2^-$#	02			β^-=100; β^-n=0.089 19	
^{79}Ge	−69490	90				18.98	s	0.03	$(1/2)^-$	02			β^-=100	
^{79}Ge^m	−69300	90	185.95	0.04		39.0	s	1.0	$7/2^+$#	02			β^-=96 1; IT=4 1	
^{79}As	−73637	6				9.01	m	0.15	$3/2^-$	02			β^-=100	
^{79}As^m	−72864	6	772.81	0.06		1.21	μs	0.01	$(9/2)^+$	02	98Gr14	T	IT=100	*
^{79}Se	−75917.6	1.7				295	ky	38	$7/2^+$	02			β^-=100	
^{79}Se^m	−75821.8	1.7	95.77	0.03		3.92	m	0.01	$1/2^-$	02			IT$\approx$100; β^-=0.056 11	
^{79}Br	−76068.5	2.0				STABLE			$3/2^-$	02			IS=50.69 7	
^{79}Br^m	−75860.9	2.0	207.61	0.09		4.86	s	0.04	$(9/2^+)$	02			IT=100	
^{79}Kr	−74443	4				35.04	h	0.10	$1/2^-$	02			β^+=100	
^{79}Kr^m	−74313	4	129.77	0.05		50	s	3	$7/2^+$	02			IT=100	
^{79}Kr^n	−74296	4	147.06	0.06		78.7	ns	1.0	$(5/2^-)$	02			IT=100	
^{79}Rb	−70803	6				22.9	m	0.5	$5/2^+$	02			β^+=100	
^{79}Sr	−65477	8				2.25	m	0.10	$3/2^{(-)}$	02			β^+=100	
^{79}Y	−58360	450				14.8	s	0.6	$5/2^+$#	02			β^+=100; β^+p ?	
^{79}Zr	−47360#	400#				56	ms	30	$5/2^+$#	02			β^+=100; β^+p ?	

*^{79}As^m T : 98Ho15=0.87(0.06) outweighed, not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{80}Cu	−36450#	600#				100#	ms	(>300 ns)		97	97Be70	I	β^- ?	
^{80}Zn	−51840	170				545	ms	16	0^+	92			β^-=100; β^-n=1.0 5	
^{80}Ga	−59140	120				1.697	s	0.011	(3)	92	93Ru01	D	β^-=100; β^-n=0.89 6	
^{80}Ge	−69515	28				29.5	s	0.4	0^+	92			β^-=100	
^{80}As	−72159	23				15.2	s	0.2	1^+	92			β^-=100	
^{80}Se	−77759.9	2.0				STABLE			0^+	92			IS=49.61 41; 2β^- ?	
^{80}Br	−75889.5	2.0				17.68	m	0.02	1^+	92			β^-=91.7 2; β^+=8.3 2	
^{80}Br^m	−75803.7	2.0	85.843	0.004		4.4205	h	0.0008	5^-	92			IT=100	
^{80}Kr	−77892.5	1.5				STABLE			0^+	92			IS=2.28 6	
^{80}Rb	−72173	7				33.4	s	0.7	1^+	92	93Al03	T	β^+=100	
^{80}Rb^m	−71679	7	494.4	0.5		1.6	μs	0.02	6^+		92Do10	E		
^{80}Sr	−70308	7				106.3	m	1.5	0^+	99			β^+=100	
^{80}Y	−61220	180				30.1	s	0.5	4^-	92	98Do04	TJ	β^+=100	*
^{80}Y^m	−60990	180	228.5	0.1		4.8	s	0.3	(1^-)		98Do04	ETJ	IT=81 2; β^+=19 2	*
^{80}Y^n	−60910	180	312.5	1.0		4.7	μs	0.3	(2^+)		00Ch07	ETJ	IT=100	*

. . . A-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{80}Zr	−55520	1490				4.6	s	0.6	0^+	92	01Ki13	T	β^+=100; β^+p ?	*
*^{80}Y	T : differences with 82De36=38(1) 81Li12=33.8(0.6) explained in 98Do04													**
*^{80}Y^m	T : average 01No07=5.0(0.5) 98Do04=4.7(0.3) D : from 98Do04													**
*^{80}Y^n	E : 00Ch07=84(1) above 228.5 level													**
*^{80}Zr	T : average 01Ki13=5.3(+1.1–0.9) 00Re03=4.1(+0.8–0.6)													**
^{81}Zn	−46130#	300#				290	ms	50	$5/2^+$#	97			β^-=100; β^-n=7.5 30	
^{81}Ga	−57980	190				1.217	s	0.005	$(5/2^-)$	97			β^-=100; β^-n=11.9 7	
^{81}Ge	−66300	120				8	s	2	$9/2^+$#	97			β^-=100	*
^{81}Ge^m	−65620	120	679.13	0.04		8	s	2	$(1/2^+)$	97			$\beta^-\approx$100; IT<1	
^{81}As	−72533	6				33.3	s	0.8	$3/2^-$	97			β^-=100	
^{81}Se	−76389.5	2.0				18.45	m	0.12	$1/2^-$	97			β^-=100	
^{81}Se^m	−76286.5	2.0	102.99	0.06		57.28	m	0.02	$7/2^+$	97			IT$\approx$100; β^-=0.052 14	
^{81}Br	−77974.8	2.0				STABLE			$3/2^-$	97			IS=49.31 7	
^{81}Br^m	−77438.6	2.0	536.20	0.09		34.6	μs		$9/2^+$					
^{81}Kr	−77694.0	2.0				229	ky	11	$7/2^+$	97			ε=100	
^{81}Kr^m	−77503.4	2.0	190.62	0.04		13.10	s	0.03	$1/2^-$	97			IT$\approx$100; ε=0.0025 4	
^{81}Rb	−75455	6				4.576	h	0.005	$3/2^-$	97			β^+=100	
^{81}Rb^m	−75369	6	86.31	0.07		30.5	m	0.3	$9/2^+$	97			IT=97.6 6; β^+=2.4 6	
^{81}Sr	−71528	6				22.3	m	0.4	$1/2^-$	99			β^+=100	
^{81}Y	−66020	60				70.4	s	1.0	$(5/2^+)$	98			β^+=100	
^{81}Zr	−58490	170				5.5	s	0.4	$3/2^-$#	00			β^+=100; β^+p=0.12 2	
^{81}Nb	−47480#	1500#				< 44	ns		$3/2^-$#	97	00We.A	I	p ?; β^+ ?; β^+p ?	*
*^{81}Ge	T : derived from 7.6(0.6), for mixture of ground-state and isomer with almost same half-life													**
*^{81}Nb	I : also 99Ja02<80 01Ki13<200 ns T : estimated half-life for β^+: 100# ms													**
^{82}Zn	−42460#	500#				100#	ms	(>300 ns)	0^+	03	97Be70	I	β^- ?	
^{82}Ga	−53100#	300#				599	ms	2	$(1,2,3)$	03	93Ru01	D	β^-=100; β^-n=21.3 13	*
^{82}Ge	−65620	240				4.55	s	0.05	0^+	03			β^-=100	
^{82}As	−70320	200			*	19.1	s	0.5	(1^+)	03			β^-=100	
^{82}As^m	−70075	25	250	200	BD *	13.6	s	0.4	(5^-)	03			β^-=100	
^{82}Se	−77594.0	2.0				97	Ey	5	0^+	03	99Pi08	T	IS=8.73 22; 2β^-=100	*
^{82}Br	−77496.5	1.9				35.282	h	0.007	5^-	03			β^-=100	
^{82}Br^m	−77450.6	1.9	45.9492	0.0010		6.13	m	0.05	2^-	03			IT=97.6 3; β^-=2.4 3	
^{82}Kr	−80589.5	1.8				STABLE			0^+	03			IS=11.58 14	
^{82}Rb	−76188.2	2.8				1.273	m	0.002	1^+	03			β^+=100	
^{82}Rb^m	−76119.1	2.4	69.1	1.5	MD	6.472	h	0.006	5^-	03			$\beta^+\approx$100; IT<0.33	
^{82}Sr	−76008	6				25.36	d	0.03	0^+	03	87Ho06	T	ε=100	*
^{82}Y	−68190	100				8.30	s	0.20	1^+	03			β^+=100	
^{82}Y^m	−67790	100	402.63	0.14		268	ns	25	4^-	03			IT=100	
^{82}Zr	−64190#	230#				32	s	5	0^+	03			β^+=100	
^{82}Nb	−52970#	300#				51	ms	5	0^+	03	01Ga24	T	β^+=100; β^+p ?	*
*^{82}Ga	D : average 93Ru01=31.1(4.4) 86Wa17=19.8(1.7) 80Lu04=21.4(2.2)													**
*^{82}Se	T : average 99Pi08=83(+9–7) 98Ar10=83(12) 92El07=108(+26–6) 88Li11=120(10)													**
*^{82}Sr	T : average 87Ho06=25.36(0.03) 87Ju02=25.342(0.053)													**
*^{82}Nb	T : average 01Ga24=52(6) 01Ki13=48(+8–6)													**
^{83}Zn	−36300#	500#				80#	ms	(>300 ns)	$5/2^+$#	01	97Be70	I	β^- ?	
^{83}Ga	−49390#	300#				308	ms	1	$3/2^-$#	01			β^-=100; β^-n=37 17	
^{83}Ge	−60900#	200#				1.85	s	0.06	$5/2^+$#	01			β^-=100	
^{83}As	−69880	220				13.4	s	0.3	$3/2^-$#	01			β^-=100	
^{83}Se	−75341	4				22.3	m	0.3	$9/2^+$	01			β^-=100	
^{83}Se^m	−75113	4	228.50	0.20		70.1	s	0.4	$1/2^-$	01			β^-=100	
^{83}Br	−79009	4				2.40	h	0.02	$3/2^-$	01			β^-=100	
^{83}Br^m	−75940	4	3068.8	0.6		700	ns	100	$(19/2^-)$	01			IT=100	
^{83}Kr	−79981.7	2.8				STABLE			$9/2^+$	01			IS=11.49 6	
^{83}Kr^m	−79972.3	2.8	9.4053	0.0008		154.4	ns	1.1	$7/2^+$	01			IT=100	
^{83}Kr^n	−79940.1	2.8	41.5569	0.0010		1.83	h	0.02	$1/2^-$	01			IT=100	
. . . *A*-group is continued on next page . . .														

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .															
^{83}Rb	−79075	6					86.2	d	0.1	$5/2^-$	01			ε=100	
^{83}Rb^m	−79033	6	42.11	0.04			7.8	ms	0.7	$9/2^+$	01	68Et01	T	IT=100	
^{83}Sr	−76795	10					32.41	h	0.03	$7/2^+$	01			β^+=100	
^{83}Sr^m	−76536	10	259.15	0.09			4.95	s	0.12	$1/2^-$	01			IT=100	
^{83}Y	−72330	40					7.08	m	0.06	$9/2^+$	01	92Bu10	J	β^+=100	
^{83}Y^m	−72270	40	61.98	0.11			2.85	m	0.02	$(3/2^-)$	01			β^+=60 5; IT=40 5	
^{83}Zr	−66460	100					41.6	s	2.4	$1/2^-$#	01			β^+=100; β^+p=?	
^{83}Zr^m	−66410	100	52.72	0.05			530	ns	0.12	$(5/2^-)$	01			IT=100	
^{83}Zr^n			non existent		RN		8	s	1	high	01	87Ra06	I	β^+=100; β^+p=?	*
^{83}Nb	−58960	310					4.1	s	0.3	$(5/2^+)$	01			β^+=100	
^{83}Mo	−47750#	500#					23	ms	19	$3/2^-$#	01	01Ki13	TD	β^+=100; β^+p ?	

*^{83}Zr^n D : 6(4)% of total β^+p go to first excited state in ^{82}Sr **
*^{83}Zr^n I : misassigned: absence of radiations suggests no isomer with E>18 keV **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{84}Ga	−44110#	400#					85	ms	10		97			β^-=100; β^-n=70 15	
^{84}Ge	−58250#	300#					954	ms	14	0^+	97	93Ru01	T	β^-=100; β^-n=10.8 6	*
^{84}As	−66080#	300#				*	4.02	s	0.03	$(3)^{(+\#)}$	97	93Ru01	T	β^-=100; β^-n=0.28 4	
^{84}As^m	−66080#	320#	0#	100#		*	650	ms	150		97			β^-=100	
^{84}Se	−75952	15					3.1	m	0.1	0^+	97			β^-=100	
^{84}Br	−77799	15					31.80	m	0.08	2^-	97			β^-=100	
^{84}Br^m	−77460	100	340	100	BD		6.0	m	0.2	(6^-)	97			β^-=100	
^{84}Br^n	−77391	15	408.2	0.4			< 140	ns		1^+	97			IT=100	
^{84}Kr	−82431.0	2.8					STABLE			0^+	97			IS=57.00 4	
^{84}Kr^m	−79195.0	2.8	3236.02	0.18			1.89	μs	0.04	8^+	97			IT=100	
^{84}Rb	−79750.0	2.8					32.77	d	0.14	2^-	97			β^+=96.2 5; β^-=3.8 5	
^{84}Rb^m	−79286.4	2.8	463.62	0.09			20.26	m	0.04	6^-	97			IT≈100; β^+=0.0012	
^{84}Sr	−80644	3					STABLE			0^+	97			IS=0.56 1; 2β^+ ?	
^{84}Y	−74160	90				*	4.6	s	0.2	1^+	97			β^+=100	
^{84}Y^m	−74230	170	−80	190	BD	*	39.5	m	0.8	(5^-)	97			β^+=100	
^{84}Zr	−71490#	200#					25.9	m	0.7	0^+	97			β^+=100	
^{84}Nb	−61880#	300#					9.8	s	0.9	3^+	97	03Do01	T	β^+=100; β^+p ?	*
^{84}Nb^m	−61540#	300#	338	10			103	ns	19	(5^-)		00Ch07	ETJ	IT=100	
^{84}Mo	−55810#	400#					3.8	ms	0.9	0^+	97	01Ki13	T	β^+=100; β^+p ?	

*^{84}Ge T : average 93Ru01=947(11) 91Kr15=984(23) **
*^{84}Nb T : average 03Do01=9.5(1.0) 77Ko05=12(3) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{85}Ga	−40050#	500#					50#	ms	(>300 ns)	$3/2^-$#	97	97Be70	I	β^- ?	
^{85}Ge	−53070#	400#					540	ms	50	$5/2^+$#	97			β^-=100; β^-n=14 3	
^{85}As	−63320#	200#					2.021	s	0.010	$3/2^-$#	97			β^-=100; β^-n=59.4 24	
^{85}Se	−72428	30					31.7	s	0.9	$5/2^+$#	97			β^-=100	
^{85}Br	−78610	19					2.90	m	0.06	$3/2^-$	91			β^-=100	
^{85}Kr	−81480.3	1.9					10.776	y	0.003	$9/2^+$	91	02Un02	T	β^-=100	
^{85}Kr^m	−81175.4	1.9	304.871	0.020			4.480	h	0.008	$1/2^-$	91			β^-=78.6 4; IT=21.4 4	
^{85}Kr^n	−79488.5	2.3	1991.8	1.3			1.6	μs	0.7	$(17/2^+)$	91			IT=100	
^{85}Rb	−82167.331	0.011					STABLE			$5/2^-$	91			IS=72.17 2	
^{85}Sr	−81102.6	2.8					64.853	d	0.008	$9/2^+$	91	02Un02	T	ε=100	
^{85}Sr^m	−80863.9	2.8	238.66	0.06			67.63	m	0.04	$1/2^-$	91			IT=86.6 4; β^+=13.4 4	
^{85}Y	−77842	19					2.68	h	0.05	$(1/2)^-$	94			β^+=100	
^{85}Y^m	−77822	19	19.8	0.5			4.86	h	0.13	$9/2^+$	94			β^+≈100; IT<0.002	
^{85}Zr	−73150	100					7.86	m	0.04	$7/2^+$	94			β^+=100	
^{85}Zr^m	−72860	100	292.2	0.3			10.9	s	0.3	$(1/2^-)$	94			IT≤92; β^+>8	
^{85}Nb	−67150	220					20.9	s	0.7	$(9/2^+)$	91			β^+=100	
^{85}Nb^m	−66390	220	759.0	1.0			12	s	5	$(1/2^-)$	91	98Oi.A	ETJ	β^+=100	
^{85}Mo	−59100#	280#					3.2	s	0.2	$1/2^-$#	97	97Hu15	TD	β^+=100; β^+p=?	
^{85}Tc	−47670#	400#					< 110	ns		$1/2^-$#		00We.A	I	p ?; β^+ ?; β^+p ?	*

*^{85}Tc I : also 99Ja02<100 ns T : estimated half-life for β^+ decay: 100# ms **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{86}Ga	−34350#	800#				30#	ms	(>300 ns)		01	97Be70	I	β^- ?	
^{86}Ge	−49840#	500#				300#	ms	(>300 ns)	0^+	01	94Be24	I	β^- ?; β^-n ?	
^{86}As	−59150#	300#				945	ms	8		01			β^-=100; β^-n=33 4	
^{86}Se	−70541	16				15.3	s	0.9	0^+	01			β^-=100	
^{86}Br	−75640	11				55.1	s	0.4	(2^-)	01			β^-=100	
^{86}Kr	−83265.57	0.10				STABLE			0^+	01			IS=17.30 22; 2β^- ?	
^{86}Rb	−82747.02	0.20				18.642	d	0.018	2^-	01			$\beta^-\approx$100; ε=0.0052 5	
^{86}Rb^m	−82190.97	0.27	556.05	0.18		1.017	m	0.003	6^-	01			IT$\approx$100; β^-<0.3	
^{86}Sr	−84523.6	1.1				STABLE			0^+	01			IS=9.86 1	
^{86}Sr^m	−81567.9	1.1	2955.68	0.21		455	ns	7	8^+	01			IT=100	
^{86}Y	−79284	14				14.74	h	0.02	4^-	97			β^+=100	
^{86}Y^m	−79066	14	218.30	0.20		48	m	1	(8^+)	01			IT=99.31 4; β^+=0.69 4	
^{86}Y^n	−78982	14	302.2	0.5		125	ns	6	(7^-)	01			IT=100	
^{86}Zr	−77800	30				16.5	h	0.1	0^+	01			β^+=100	
^{86}Nb	−69830	90			*	88	s	1	(6^+)	01			β^+=100	
^{86}Nb^m	−69580#	180#	250#	160#	*	56	s	8	high	01	94Sh07	JD	β^+=100	*
^{86}Mo	−64560	440				19.6	s	1.1	0^+	01			β^+=100	
^{86}Tc	−53210#	300#				55	ms	6	(0^+)	01	01Ga24	TJ	β^+=100; β^+p ?	*
^{86}Tc^m	−51710#	340#	1500	150		1.11	μs	0.21	$(5^+,5^-)$	01	00Ch07	EJ	IT=100	*

*^{86}Nb^m I : existence considered as uncertain in ENSDF'01; needs confirmation **
*^{86}Tc T : average 01Ga24=44(12) 01Ki13=59(+8–7) **
*^{86}Tc^m E : above the 4^+ state at 1328 or 1445 keV **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{87}Ge	−44240#	500#				150#	ms	(>300 ns)	$5/2^+$#	02	97Be70	I	β^- ?; β^-n ?	
^{87}As	−55980#	300#				610	ms	120	$3/2^-$#	02	93Ru01	T	β^-=100; β^-n=15.4 22	*
^{87}Se	−66580	40				5.50	s	0.12	$5/2^+$#	02			β^-=100; β^-n=0.20 4	
^{87}Br	−73857	18				55.65	s	0.13	$3/2^-$	02			β^-=100; β^-n=2.60 4	
^{87}Kr	−80709.43	0.27				76.3	m	0.5	$5/2^+$	02			β^-=100	
^{87}Rb	−84597.795	0.012				49.23	Gy	0.22	$3/2^-$	02	82Mi14	T	IS=27.83 2; β^-=100	*
^{87}Sr	−84880.4	1.1				STABLE			$9/2^+$	02			IS=7.00 1	
^{87}Sr^m	−84491.9	1.1	388.533	0.003		2.815	h	0.012	$1/2^-$	02			IT$\approx$100; ε=0.30 8	
^{87}Y	−83018.7	1.6				79.8	h	0.3	$1/2^-$	02			β^+=100	
^{87}Y^m	−82637.9	1.6	380.82	0.07		13.37	h	0.03	$9/2^+$	02			IT=98.43 10; β^+=1.57 10	
^{87}Zr	−79348	8				1.68	h	0.01	$(9/2)^+$	02			β^+=100	
^{87}Zr^m	−79012	8	335.84	0.19		14.0	s	0.2	$(1/2)^-$	02			IT=100	
^{87}Nb	−74180	60				3.75	m	0.09	$(1/2^-)$	02			β^+=100	
^{87}Nb^m	−74180	60	3.84	0.14		2.6	m	0.1	$9/2^+$#	02			β^+=100	
^{87}Mo	−67690	220				14.05	s	0.23	$7/2^+$#	02	97Hu07	TD	β^+=100; β^+p=15 5	*
^{87}Tc	−59120#	300#			*	2.18	s	0.16	$1/2^-$#	02	00We.A	TD	β^+=100; β^+p ?	
^{87}Tc^m	−59100#	310#	20#	60#	*	2#	s		$9/2^+$#				β^+ ?; IT ?	
^{87}Ru	−47340#	600#				50#	ms	(>1.5 μs)	$1/2^-$#	02	95Ry03	I	β^+ ?	

*^{87}As T : unweighed average 93Ru01=485(40) 78Cr03=730(60) (Birge ratio B=3.4) **
*^{87}Rb T : average 82Mi14=49.44(0.28) 74Ne14=48.8(0.8) 77Da22=48.9(0.4) obtained by **
*^{87}Rb T : three methods, respectively: geochronology, decay counting, chemical **
*^{87}Rb T : 77Da22 supersedes 66Mc12=47.2(0.4) using the same material **
*^{87}Mo T : average 97Hu07=13.6(1.1) 91Mi15=14.5(0.3) 83Ha06=13.3(0.4) **
*^{87}Mo D : average 97Hu07=15(6)% (through 3 levels) 83Ha06=15(8)% first 2^+ state **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{88}Ge	−40140#	700#				80#	ms	(>300 ns)	0^+	97	97Be70	I	β^- ?	
^{88}As	−51290#	500#				300#	ms	(>300 ns)		97	94Be24	I	β^- ?; β^-n ?	
^{88}Se	−63880	50				1.53	s	0.06	0^+	97			β^-=100; β^-n=0.99 10	
^{88}Br	−70730	40				16.36	s	0.07	$(2^-,1^+)$	98	93Ru01	T	β^-=100; β^-n=6.58 18	*
^{88}Br^m	−70460	40	272.7	0.3		5.4	μs	0.7		98			IT=100	
^{88}Kr	−79692	13				2.84	h	0.03	0^+	88			β^-=100	
^{88}Rb	−82609.00	0.16				17.78	m	0.11	2^-	88			β^-=100	
^{88}Sr	−87921.7	1.1				STABLE			0^+	88			IS=82.58 1	
^{88}Y	−84299.1	1.9				106.65	d	0.04	4^-	88			β^+=100	
^{88}Y^m	−83624.6	1.9	674.55	0.04		13.9	ms	0.2	$(8)^+$	88			IT=100	
^{88}Y^n	−83906.2	1.9	392.86	0.09		300	μs	3	1^+	88				
^{88}Zr	−83623	10				83.4	d	0.3	0^+	88			ε=100	
^{88}Nb	−76070	100			*	14.5	m	0.1	(8^+)	88			β^+=100	
^{88}Nb^m	−76030	100	40	140	BD *	7.8	m	0.1	(4^-)	88			β^+=100	
^{88}Mo	−72700	20				8.0	m	0.2	0^+	97			β^+=100	
^{88}Tc	−62710#	200#			*	5.8	s	0.2	$(2,3)$	97			β^+=100	
^{88}Tc^m	−62710#	360#	0#	300#	*	6.4	s	0.8	$(6,7,8)$	97			β^+=100	
^{88}Ru	−55650#	400#				1.3	s	0.3	0^+	97	01Ki13	TD	β^+=100; β^+p ?	

*^{88}Br T : average 93Ru01=16.34(0.08) 74Gr29=16.5(0.2) J : systematics prefers (2^-) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{89}Ge	−33690#	900#				50#	ms	(>300 ns)	$3/2^+$#	98	97Be70	I	β^- ?	
^{89}As	−47140#	500#				200#	ms	(>300 ns)	$3/2^-$#	98	94Be24	I	β^- ?	
^{89}Se	−59200#	300#				410	ms	40	$5/2^+$#	98			β^-=100; β^-n=7.8 25	
^{89}Br	−68570	60				4.40	s	0.03	$(3/2^-,5/2^-)$	98			β^-=100; β^-n=13.8 4	*
^{89}Kr	−76730	50				3.15	m	0.04	$3/2^{(+\#)}$	98	95Ke04	J	β^-=100	
^{89}Rb	−81713	5				15.15	m	0.12	$3/2^-$	98			β^-=100	
^{89}Sr	−86209.1	1.1				50.53	d	0.07	$5/2^+$	98			β^-=100	
^{89}Y	−87701.7	2.6				STABLE			$1/2^-$	98			IS=100.	
^{89}Y^m	−86792.7	2.6	908.97	0.03		15.663	s	0.005	$9/2^+$	98	94It.A	T	IT=100	
^{89}Zr	−84869	4				78.41	h	0.12	$9/2^+$	98			β^+=100	
^{89}Zr^m	−84281	4	587.82	0.10		4.161	m	0.017	$1/2^-$	98			IT=93.77 12; ...	*
^{89}Nb	−80650	27			*	2.03	h	0.07	$(9/2^+)$	98			β^+=100	
^{89}Nb^m	−80650#	40#	0#	30#	*	1.10	h	0.03	$(1/2)^-$	98			β^+=100	
^{89}Mo	−75004	15				2.11	m	0.10	$(9/2^+)$	98			β^+=100	
^{89}Mo^m	−74617	15	387.5	0.2		190	ms	15	$(1/2^-)$	98			IT=100	
^{89}Tc	−67840#	200#				12.8	s	0.9	$(9/2^+)$	98			β^+=100	
^{89}Tc^m	−67780#	200#	62.6	0.5		12.9	s	0.8	$(1/2^-)$	98			$\beta^+\approx$100; IT<0.01	
^{89}Ru	−59510#	500#				1.38	s	0.11	$(7/2)^{(+\#)}$	98	00We.A	T	β^+=100; β^+p=?	*
^{89}Rh	−47660#	450#				10#	ms	(>1.5 μs)	$7/2^+$#	98	95Ry03	I	β^+ ?	*

*^{89}Br T : ENSDF averages 8 values. Also 93Ru01=4.348(0.022) **
*^{89}Zr^m D : ... ; β^+=6.23 12 **
*^{89}Ru T : average 00We.A=1.45(0.13) 99Li33=1.2(0.2); same group 01Ki13=1.5(0.2) **
*^{89}Rh I : unobserved in 00We.A, at detection limit **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{90}As	−41450#	800#				80#	ms	(>300 ns)			97Be70	I	β^- ?	
^{90}Se	−55930#	400#				300#	ms	(>300 ns)	0^+		94Be24	I	β^- ?; β^-n ?	
^{90}Br	−64620	80				1.910	s	0.010		98	93Ru01	T	β^-=100; β^-n=25.2 9	*
^{90}Kr	−74970	19				32.32	s	0.09	0^+	98			β^-=100	
^{90}Rb	−79362	7				158	s	5	0^-	98			β^-=100	
^{90}Rb^m	−79255	7	106.90	0.03		258	s	4	3^-	98			β^-=97.4 4; IT=2.6 4	
^{90}Rb^x	−79291	14	71	12		$R=2$ 1			fsmix					
^{90}Sr	−85941.6	2.9				28.79	y	0.06	0^+	98			β^-=100	
^{90}Y	−86487.5	2.6				64.00	h	0.21	2^-	98			β^-=100	
^{90}Y^m	−85805.8	2.6	681.67	0.10		3.19	h	0.06	7^+	98			IT≈100; β^-=0.0018 2	
^{90}Zr	−88767.3	2.4				STABLE			0^+	98			IS=51.45 40	
^{90}Zr^m	−86448.3	2.4	2319.000	0.010		809.2	ms	2.0	5^-	98			IT=100	
^{90}Zr^n	−85177.9	2.4	3589.419	0.016		131	ns	4	8^+	98			IT=100	
^{90}Nb	−82656	5				14.60	h	0.05	8^+	98			β^+=100	
^{90}Nb^m	−82534	5	122.370	0.022		63	μs	2	6^+	98			IT=100	
^{90}Nb^n	−82531	5	124.67	0.25		18.81	s	0.06	4^-	98			IT=100	
^{90}Nb^p	−82485	5	171.10	0.10		<1	μs		7^+	98			IT=100	
^{90}Nb^q	−82274	5	382.01	0.25		6.19	ms	0.08	1^+	98			IT=100	
^{90}Nb^r	−80776	5	1880.21	0.20		472	ns	13	(11^-)	98			IT=100	
^{90}Mo	−80167	6				5.56	h	0.09	0^+	98			β^+=100	
^{90}Mo^m	−77292	6	2874.73	0.15		1.12	μs	0.05	8^+#	98			IT=100	
^{90}Tc	−71210	240			* &	8.7	s	0.2	1^+	98			β^+=100	
^{90}Tc^m	−70900	300	310	390	BD * &	49.2	s	0.4	(8^+)	98	93Ru03	J	β^+=100	*
^{90}Ru	−65310#	300#				11	s	3	0^+	98			β^+=100	
^{90}Rh	−53220#	500#			*	15	ms	7	0^+#	98	01Ki13	TD	β^+=100; β^+p ?	
^{90}Rh^m	−53220#	710#	0#	500#	*	1.1	s	0.3	9^+#		01Ki13	TD	β^+=100; β^+p ?	

*^{90}Br T : supersedes 80Al15=1.92(0.02) from same group **
*^{90}Tc^m E : arguments are given in 93Ru03 for the (8^+) level to be the ground-state **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{91}As	−36860#	900#				50#	ms	(>300 ns)	$3/2^-$#	99	97Be70	I	β^- ?	
^{91}Se	−50340#	500#				270	ms	50	$1/2^+$#	99			β^-=100; β^-n=21 10	
^{91}Br	−61510	70				541	ms	5	$3/2^-$#	99			β^-=100; β^-n=20 3	
^{91}Kr	−71310	60				8.57	s	0.04	$5/2^{(+)}$	01			β^-=100	
^{91}Rb	−77745	8				58.4	s	0.4	$3/2^{(-)}$	99			β^-=100	
^{91}Sr	−83645	5				9.63	h	0.05	$5/2^+$	01			β^-=100	
^{91}Sr^x	−83599	11	47	11		$R=6$			mix					
^{91}Y	−86345.0	2.9				58.51	d	0.06	$1/2^-$	99			β^-=100	
^{91}Y^m	−85789.4	2.9	555.58	0.05		49.71	m	0.04	$9/2^+$	99			IT>98.5; β^-<1.5	
^{91}Zr	−87890.4	2.3				STABLE			$5/2^+$	01			IS=11.22 5	
^{91}Zr^m	−84723.1	2.3	3167.3	0.4		4.35	μs	0.14	$(21/2^+)$	01			IT=100	
^{91}Nb	−86632	4				680	y	130	$9/2^+$	99	91Hi.A	D	ε≈100; e$^+$=0.0138 25	
^{91}Nb^m	−86527	4	104.60	0.05		60.86	d	0.22	$1/2^-$	99	91Hi.A	D	IT=96.6 5; ε=3.4 5; ...	*
^{91}Nb^n	−84598	4	2034.35	0.19		3.76	μs	0.12	$(17/2^-)$	99			IT=100	
^{91}Mo	−82204	11				15.49	m	0.01	$9/2^+$	99			β^+=100	
^{91}Mo^m	−81551	11	653.01	0.09		64.6	s	0.6	$1/2^-$	99			IT=50.0 16; β^+=50.0 16	
^{91}Tc	−75980	200				3.14	m	0.02	$(9/2)^+$	99			β^+=100	
^{91}Tc^m	−75840	200	139.3	0.3		3.3	m	0.1	$(1/2)^-$	99			β^+>99; IT<1	
^{91}Ru	−68660#	580#			*	9	s	1	$(9/2^+)$	99			β^+=100	
^{91}Ru^m	−68580	500	80#	300#	*	7.6	s	0.8	$(1/2^-)$	99			β^+≈100; β^+p=?; IT ?	
^{91}Rh	−59100#	400#				1.74	s	0.14	$7/2^+$#	99	00We.A	TD	β^+=100; β^+p ?	
^{91}Pd	−47400#	570#				10#	ms	(>1.5 μs)	$7/2^+$#	99	95Ry03	I	β^+ ?	

*^{91}Nb^m D : . . . ; e$^+$=0.0028 2 **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{92}As	−30930#	900#			30#	ms	(>300 ns)		01	97Be70	I	β^- ?	
^{92}Se	−46650#	600#			100#	ms	(>300 ns)	0^+	01	97Be70	I	β^- ?	
^{92}Br	−56580	50			343	ms	15	(2^-)	01			β^-=100; β^-n=33.1 25	
^{92}Kr	−68785	12			1.840	s	0.008	0^+	01			β^-=100; β^-n=0.0332 25	
^{92}Rb	−74772	6			4.492	s	0.020	0^-	01			β^-=100; β^-n=0.0107 5	
^{92}Sr	−82868	3			2.66	h	0.04	0^+	03			β^-=100	
^{92}Y	−84813	9			3.54	h	0.01	2^-	01			β^-=100	
^{92}Zr	−88453.9	2.3			STABLE			0^+	01			IS=17.15 8	
^{92}Nb	−86448.3	2.8			34.7	My	2.4	$(7)^+$	01			$\beta^+\approx$100; β^-<0.05	
^{92}Nb^m	−86312.8	2.8	135.5	0.4	10.15	d	0.02	$(2)^+$	01			β^+=100	
^{92}Nb^n	−86222.6	2.8	225.7	0.4	5.9	μs	0.2	$(2)^-$	01			IT=100	
^{92}Nb^p	−84245.0	2.8	2203.3	0.4	167	ns	4	(11^-)	01			IT=100	
^{92}Mo	−86805	4			STABLE		(>190 Ey)	0^+	01	97Ba35	T	IS=14.84 35; 2β^+ ?	*
^{92}Mo^m	−84045	4	2760.46	0.16	190	ns	3	8^+	01			IT=100	
^{92}Tc	−78935	26			4.25	m	0.15	$(8)^+$	01			β^+=100	
^{92}Tc^m	−78665	26	270.15	0.11	1.03	μs	0.07	(4^+)	01			IT=100	
^{92}Ru	−74410#	300#			3.65	m	0.05	0^+	01			β^+=100	
^{92}Rh	−63360#	400#			4.3	s	1.3	(6^+)	01	01Xu05	TJD	β^+=100; β^+p=?	*
^{92}Pd	−55500#	500#			1.1	s	0.3	0^+	01	01Ki13	TD	β^+=100; β^+p ?	

*^{92}Mo T : T>190 Ey (2σ) **
*^{92}Rh T : unweighed average 01Xu05=3.0(0.8) 01Ki13=5.6(0.5) (Birge ratio B=2.76) **
*^{92}Rh J : from 97Ka07; 01Xu05>4 **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{93}Se	−40720#	800#			50#	ms	(>300 ns)	$1/2^+$#	97	97Be70	I	β^- ?	
^{93}Br	−53050#	300#			102	ms	10	$3/2^-$#	01			β^-=100; β^-n=68 7	
^{93}Kr	−64020	100			1.286	s	0.010	$1/2^+$	01			β^-=100; β^-n=1.95 11	
^{93}Rb	−72618	8			5.84	s	0.02	$5/2^-$	97			β^-=100; β^-n=1.39 7	
^{93}Rb^m	−72365	8	253.38	0.03	57	μs	15	$(3/2^-,5/2^-)$	97			IT=100	
^{93}Sr	−80085	8			7.423	m	0.024	$5/2^+$	97			β^-=100	
^{93}Y	−84223	11			10.18	h	0.08	$1/2^-$	97			β^-=100	
^{93}Y^m	−83464	11	758.719	0.021	820	ms	40	$7/2^+$	97			IT=100	
^{93}Zr	−87117.0	2.3			1.53	My	0.10	$5/2^+$	97			β^-=100	
^{93}Nb	−87208.3	2.4			STABLE			$9/2^+$	97			IS=100.	
^{93}Nb^m	−87177.5	2.4	30.77	0.02	16.13	y	0.14	$1/2^-$	97			IT=100	
^{93}Mo	−86803	4			4.0	ky	0.8	$5/2^+$	97			ε=100	
^{93}Mo^m	−84378	4	2424.89	0.03	6.85	h	0.07	$21/2^+$	97			IT$\approx$100; β^+=0.12 1	
^{93}Tc	−83603	4			2.75	h	0.05	$9/2^+$	01			β^+=100	
^{93}Tc^m	−83211	4	391.84	0.08	43.5	m	1.0	$1/2^-$	01			IT=76.6 11; β^+=23.4 11	
^{93}Tc^n	−81418	4	2185.16	0.15	10.2	μs	0.3	$(17/2)^-$	01				
^{93}Ru	−77270	90			59.7	s	0.6	$(9/2)^+$	97			β^+=100	
^{93}Ru^m	−76540	90	734.40	0.10	10.8	s	0.3	$(1/2)^-$	97	83Ay01	D	β^+=78.0 23; ...	*
^{93}Ru^n	−75190	90	2082.6	0.9	2.20	μs	0.17	$(21/2)^+$	97			IT=100	
^{93}Rh	−69170#	400#			13.9	s	1.6	$9/2^+$#	01	01Ki13	TD	β^+=100; β^+p ?	
^{93}Pd	−59700#	400#			1.07	s	0.12	$(9/2^+)$	01	01Ki13	TJD	β^+=100; β^+p=?	*
^{93}Ag	−46780#	600#			5#	ms	(>1.5 μs)	$9/2^+$#	97	95Ry03	I	p ?; β^+ ?	*

*^{93}Ru^m D : ... ; IT=22.0 23; β^+p=0.027 5 **
*^{93}Pd T : average 01Ki13=1000(200) 01Xu05=1300(200) 00Sc31=900(200) D : β^+p=1.7# **
*^{93}Ag I : the few events reported in 94He28 are not trusted by NUBASE **
*^{93}Ag T : estimated half-life is for β^+ decay; p-decay would be much shorter **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{94}Se	−36800#	800#				20#	ms	(>300 ns)	0^+	97	97Be70	I	β^- ?	
^{94}Br	−47800#	400#				70	ms	20		92			β^-=100; β^-n=70 15	
^{94}Kr	−61140#	300#				210	ms	4	0^+	01	03Be05	TD	β^-=100; β^-n=1.11 7	*
^{94}Rb	−68553	8				2.702	s	0.005	$3^{(-)}$	92	93Ru01	D	β^-=100; β^-n=10.01 23	
^{94}Sr	−78840	7				75.3	s	0.2	0^+	92			β^-=100	
^{94}Y	−82348	7				18.7	m	0.1	2^-	92			β^-=100	
^{94}Zr	−87266.8	2.4				STABLE		(>110 Py)	0^+	92	99Ar25	T	IS=17.38 28; $2\beta^-$?	
^{94}Nb	−86364.5	2.4				20.3	ky	1.6	$(6)^+$	92			β^-=100	
^{94}Nb^m	−86323.6	2.4	40.902	0.012		6.263	m	0.004	3^+	92			IT=99.50 6; β^-=0.50 6	
^{94}Mo	−88409.7	1.9				STABLE			0^+	97			IS=9.25 12	
^{94}Tc	−84154	4				293	m	1	7^+	92			β^+=100	
^{94}Tc^m	−84079	4	75.5	1.9		52.0	m	1.0	$(2)^+$	92			$\beta^+\approx$100; IT<0.1	
^{94}Ru	−82568	13				51.8	m	0.6	0^+	92			β^+=100	
^{94}Ru^m	−79923	13	2644.55	0.25		71	μs	4	(8^+)	92			IT=100	
^{94}Rh	−72940#	450#			*	70.6	s	0.6	$(2^+,4^+)$	92	96Jo06	J	β^+=100; β^+p=1.8 5	
^{94}Rh^m	−72640	400	300#	200#	*	25.8	s	0.2	(8^+)	92			β^+=100	
^{94}Pd	−66350#	400#				9.0	s	0.5	0^+	02			β^+=100	
^{94}Pd^m	−61470#	400#	4884.4	0.5		530	ns	10	(14^+)	02			IT=100	
^{94}Ag	−53300#	500#				37	ms	18	0^+#	02			β^+=100; β^+p ?	
^{94}Ag^m	−51950#	640#	1350#	400#		422	ms	16	(7^+)	02	02La18	TJ	β^+=100; β^+p=?	*
^{94}Ag^n	−46800#	500#	6500#	2000#		300	ms	200	(21^+)	02	02La18	TJ	β^+=100; β^+p=?	

*^{94}Kr T : average 03Be05=212(5) 72Am01=200(10); others outweighed not used: **
*^{94}Kr T : 03Be05=210(20) 75As04=220(20) and 96Me09=330(100) **
*^{94}Ag^m T : average 02La18=360(30) 01Ki13=450(20) 94Sc35=420(50) **

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{95}Br	−43900#	500#			50#	ms	(>300 ns)	$3/2^-$#	97	97Be70	I	β^- ?	
^{95}Kr	−56040#	400#			114	ms	3	$1/2^{(+)}$	95	03Be05	TD	β^-=100; β^-n=2.87 18	*
^{95}Rb	−65854	21			377.5	ms	0.8	$5/2^-$	95			β^-=100; β^-n=8.73 20	
^{95}Sr	−75117	7			23.90	s	0.14	$1/2^+$	94			β^-=100	
^{95}Y	−81207	7			10.3	m	0.1	$1/2^-$	94			β^-=100	
^{95}Zr	−85657.8	2.4			64.032	d	0.006	$5/2^+$	00			β^-=100	
^{95}Nb	−86781.9	2.0			34.991	d	0.006	$9/2^+$	00			β^-=100	
^{95}Nb^m	−86546.2	2.0	235.690	0.020	3.61	d	0.03	$1/2^-$	00			IT=94.4 6; β^-=5.6 6	
^{95}Mo	−87707.5	1.9			STABLE			$5/2^+$	00			IS=15.92 13	
^{95}Tc	−86017	5			20.0	h	0.1	$9/2^+$	95			β^+=100	
^{95}Tc^m	−85978	5	38.89	0.05	61	d	2	$1/2^-$	95			β^+=96.12 32; IT=3.88 32	
^{95}Ru	−83450	12			1.643	h	0.014	$5/2^+$	94			β^+=100	
^{95}Rh	−78340	150			5.02	m	0.10	$(9/2)^+$	94			β^+=100	
^{95}Rh^m	−77800	150	543.3	0.3	1.96	m	0.04	$(1/2)^-$	94			IT=88 5; β^+=12 5	
^{95}Pd	−70150#	400#			10#	s		$9/2^+$#	95	97Sc30	TD	β^+=100	*
^{95}Pd^m	−68290	300	1860#	500#	13.3	s	0.3	$(21/2^+)$	95			β^+=?; IT=5#; …	*
^{95}Ag	−60100#	400#			1.74	s	0.13	$(9/2^+)$	95	94Sc35	TJD	β^+=100; β^+p=?	*
^{95}Ag^m	−59760#	400#	344.2	0.3	< 0.5	s		$(1/2^-)$		03Do.1	ETJ	IT=100	
^{95}Ag^n	−57570#	400#	2531	1	< 16	ms		$(23/2^+)$		03Do.1	ETJ	IT=100	
^{95}Ag^p	−55240#	400#	4859	1	< 40	ms		$(37/2^+)$		03Do.1	ETJ	IT=100	
^{95}Cd	−46700#	600#			5#	ms		$9/2^+$#				β^+ ?; β^+p ?	

*^{95}Kr J : from 95Ke04 **
*^{95}Pd T : 1.35(0.26) s in 97Sc30, if the 1219.3 keV γ originates from ground-state; **
*^{95}Pd T : 1.7 s < T < 7.5 s in Schmidt's thesis 1995 cited in 97Sc30t **
*^{95}Pd^m D : … ; β^+p=0.90 16 **
*^{95}Ag T : from 97Sc30 for $\beta^+\gamma$ activity; supersedes 94Sc35=2.0(0.1) by same authors **
*^{95}Ag T : also 03Do.1=1.85(0.34), same group **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{96}Br	−38630#	700#					20#	ms	(>300 ns)		97	97Be70	I	β^- ?	
^{96}Kr	−53030#	500#					80	ms	7	0^+	97	03Be05	TD	β^-=100; β^-n=3.7 4	
^{96}Rb	−61225	29				*	203	ms	3	2^+	95	93Ru01	D	β^-=100; β^-n=13.4 4	*
^{96}Rb^m	−61230#	200#	0#	200#		*	200#	ms	(>1 ms)	$1^{(-\#)}$		81Bo30	JI	β^- ?; IT ?; β^-n ?	*
^{96}Sr	−72939	27					1.07	s	0.01	0^+	93			β^-=100	
^{96}Y	−78347	23					5.34	s	0.05	0^-	93			β^-=100	
^{96}Y^m	−77206	21	1140	30	BD		9.6	s	0.2	$(8)^+$	93			β^-=100	
^{96}Zr	−85442.8	2.8					24	Ey	6	0^+	98	99Ar25	T	IS=2.80 9; 2β^-=100	*
^{96}Nb	−85604	4					23.35	h	0.05	6^+	93			β^-=100	
^{96}Mo	−88790.5	1.9					STABLE			0^+	93			IS=16.68 2	
^{96}Tc	−85817	5					4.28	d	0.07	7^+	93			β^+=100	
^{96}Tc^m	−85783	5	34.28	0.07			51.5	m	1.0	4^+	93			IT=98.0 5; β^+=2.0 5	
^{96}Ru	−86072	8					STABLE		(>67 Py)	0^+	01	85No03	T	IS=5.54 14; 2β^+ ?	
^{96}Rh	−79679	13					9.90	m	0.10	(6^+)	93			β^+=100	
^{96}Rh^m	−79627	13	52.0	0.1			1.51	m	0.02	(3^+)	93			IT=60 5; β^+=40 5	
^{96}Pd	−76230	150					122	s	2	0^+	93			β^+=100	
^{96}Pd^m	−73700	150	2530.8	0.1			1.81	μs	0.01	8^+	93	98Gr.B	TD	IT=100	*
^{96}Ag	−64570#	400#				*	4.45	s	0.04	(8^+)	93	03Ba39	TJ	β^+=100; β^+p=9.7 17	*
^{96}Ag^m	−64570#	400#	0#	50#		*	6.9	s	0.6	(2^+)		03Ba39	TJD	β^+=100; β^+p=18 5	
^{96}Ag^n	−64570#	400#					700	ns	200			97Gr02	T	IT ?	
^{96}Cd	−56100#	500#					1#	s		0^+				β^+ ?	

*^{96}Rb T : ENSDF average of 8 values. There is also 93Ru01=201(1) **
*^{96}Rb^m I : non-observation by 81Th04 is not in contradiction with 81Bo30 experiment **
*^{96}Rb^m I : existence of this isomer is discussed in ENSDF **
*^{96}Zr T : from 21(+8–4 statistics + 2 systematics); other 93Ka12=39(9) in geochemical **
*^{96}Zr T : experiment, not used: observation of 2β^- decay questionned by 96Ba37 **
*^{96}Pd^m T : supersedes 97Gr02=1.7(0.1); other 83Gr01=2.2(0.3) outweighed **
*^{96}Ag T : average 03Ba39=4.40(0.06) 97Sc30=4.50(0.06) **
*^{96}Ag D : average β^+p 97Sc30=11.9(2.6) 82Ku15=8.0(2.3); 96He25=3.7(0.9) not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{97}Br	−34650#	800#					10#	ms	(>300 ns)	3/2−#	97	97Be70	I	β^- ?	
^{97}Kr	−47920#	500#					63	ms	4	3/2+#		03Be05	TD	β^-=100; β^-n=6.7 6	
^{97}Rb	−58360	30					169.9	ms	0.7	$3/2^+$	93	93Ru01	D	β^-=100; β^-n=25.7 8	
^{97}Sr	−68788	19					429	ms	5	$1/2^+$	93			β^-=100; β^-n<0.05	
^{97}Sr^m	−68480	19	308.13	0.11			170	ns	10	$(7/2)^+$	93			IT=100	
^{97}Sr^n	−67957	19	830.8	0.2			255	ns	10	11/2−#	93			IT=100	
^{97}Y	−76258	12					3.75	s	0.03	$(1/2^-)$	93	93Ru01	D	β^-=100; β^-n=0.058 7	
^{97}Y^m	−75590	12	667.51	0.23			1.17	s	0.03	$(9/2)^+$	93			β^->99.3; IT<0.7; …	*
^{97}Y^n	−72735	12	3523.3	0.4			142	ms	8	$(27/2^-)$	93			IT≥80; β^-≤20	
^{97}Zr	−82946.6	2.8					16.90	h	0.05	$1/2^+$	93			β^-=100	
^{97}Nb	−85605.6	2.6					72.1	m	0.7	$9/2^+$	93			β^-=100	
^{97}Nb^m	−84862.3	2.6	743.35	0.03			52.7	s	1.8	$1/2^-$	93			IT=100	
^{97}Mo	−87540.4	1.9					STABLE			$5/2^+$	93			IS=9.55 8	
^{97}Tc	−87220	5					2.6	My	0.4	$9/2^+$	93			ε=100	
^{97}Tc^m	−87123	5	96.56	0.06			90.1	d	1.0	$1/2^-$	93			IT≈100; ε<0.34	
^{97}Ru	−86112	8					2.9	d	0.1	$5/2^+$	93			β^+=100	
^{97}Rh	−82590	40					30.7	m	0.6	$9/2^+$	93			β^+=100	
^{97}Rh^m	−82330	40	258.85	0.17			46.2	m	1.6	$1/2^-$	93			β^+=94.4 6; IT=5.6 6	
^{97}Pd	−77800	300					3.10	m	0.09	5/2+#	01			β^+=100	
^{97}Ag	−70820	320					25.3	s	0.3	$(9/2^+)$	93	97Sc30	T	β^+=100	
^{97}Ag^m	−68480	320	2343	49			5	ns		$(21/2^+)$					
^{97}Cd	−60600#	400#					2.8	s	0.6	9/2+#	93	97Sc30	T	β^+=100; β^+p=?	
^{97}In	−47000#	600#					5#	ms		9/2+#				p ?; β^+ ?	*

*^{97}Y^m D : … ; β^-n<0.08 **
*^{97}In T : estimated half-life is for β^+ decay; p-decay would be much shorter **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{98}Kr	−44800#	600#					46	ms	8	0^+	03			β^-=100; β^-n=7.0 10	
^{98}Rb	−54220	50					114	ms	5	$(0,1)^{(-\#)}$	03			β^-=100; β^-n=13.8 6; ...	*
^{98}Rb^m	−53940	120	290	130	BD		96	ms	3	$(3,4)^{(+\#)}$	03			β^-=100	
^{98}Sr	−66646	26					653	ms	2	0^+	03			β^-=100; β^-n=0.25 5	
^{98}Y	−72467	25					548	ms	2	$(0)^-$	03			β^-=100; β^-n=0.331 24	
^{98}Y^m	−72050	30	410	30	BD		2.0	s	0.2	$(5^+,4^-)$	03			β^-=?; IT=10#; ...	*
^{98}Y^n	−71971	25	496.19	0.15			7.6	μs	0.4	(2^-)	03			IT=100	
^{98}Y^p	−72296	25	170.74	0.6			620	ns	80	$(2)^-$	03			IT=100	
^{98}Zr	−81287	20					30.7	s	0.4	0^+	03			β^-=100	
^{98}Nb	−83529	6					2.86	s	0.06	1^+	03			β^-=100	
^{98}Nb^m	−83445	7	84	4			51.3	m	0.4	(5^+)	03			$\beta^-\approx$100; IT=0.1#	
^{98}Mo	−88111.7	1.9					STABLE		(>100 Ty)	0^+	03	52Fr23	T	IS=24.13 31; 2β^- ?	*
^{98}Tc	−86428	4					4.2	My	0.3	$(6)^+$	03			β^-=100; β^+=0	
^{98}Tc^m	−86337	4	90.76	0.16			14.7	μs	3	$(2)^-$	03			IT=100	
^{98}Ru	−88224	6					STABLE			0^+	03			IS=1.87 3	
^{98}Rh	−83175	12				*	8.72	m	0.12	$(2)^+$	03			β^+=100	
^{98}Rh^m	−83120#	50#	60#	50#		*	3.6	m	0.2	(5^+)	03			IT=89 5; β^+=11 5	
^{98}Pd	−81300	21					17.7	m	0.3	0^+	03			β^+=100	
^{98}Ag	−73060	70					47.5	s	0.3	(5^+)	03	ABBW03	J	β^+=100; β^+p=0.0012 5	*
^{98}Ag^m	−72890	70	167.83	0.15			220	ns	20	(3^+)	03	98Gr.B	ETD	IT=100	
^{98}Cd	−67630	80					9.2	s	0.3	0^+	03			β^+=100; β^+p<0.025	
^{98}Cd^m	−65200	80	2427.5	0.6			190	ns	20	8^+#	98	98Gr.B	TD	IT=100	*
^{98}In	−53900#	200#				*	45	ms	23	0^+#	03	01Ki13	TD	β^+=100; β^+p ?	
^{98}In^m	−53900#	540#	0#	500#		*	1.7	s	0.8		03	01Ki13	TD	β^+=100; β^+p ?	

*^{98}Rb D : ... ; β^-2n=0.051 7 **
*^{98}Y^m D : ... ; β^-n=3.4 10 **
*^{98}Y^m J : 94St31=(5$^+$) 95Ha.B=(4-) **
*^{98}Mo T : limit given here is for 0ν-2β^- decay (theoretically faster, see text) **
*^{98}Ag J : (5$^+$) with experimental basis preferred to (6$^+$), see discussion in ENSDF **
*^{98}Cd^m T : supersedes 97Gr02=200(+300–170); other 97Go18=480(160) outweighed **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{99}Kr	−39500#	600#					40	ms	11	$3/2^+$#	97	03Be05	TD	β^-=100; β^-n=11 7	
^{99}Rb	−50880	130					50.3	ms	0.7	$(5/2^+)$	98			β^-=100; β^-n=15.9 20	
^{99}Sr	−62190	80					269	ms	1	$3/2^+$	95			β^-=100; β^-n=0.100 19	
^{99}Y	−70201	24					1.470	s	0.007	$(5/2^+)$	95			β^-=100; β^-n=1.9 4	
^{99}Y^m	−68059	24	2141.65	0.19			8.6	μs	0.8	$(17/2^+)$	95			IT=100	
^{99}Zr	−77768	20					2.1	s	0.1	$1/2^+$	95	02Ca37	J	β^-=100	
^{99}Nb	−82327	13					15.0	s	0.2	$9/2^+$	95			β^-=100	
^{99}Nb^m	−81962	13	365.29	0.14			2.6	m	0.2	$1/2^-$	95			β^-=?; IT<3.8	
^{99}Mo	−85965.8	1.9					65.94	h	0.01	$1/2^+$	95			β^-=100	
^{99}Mo^m	−85868.0	1.9	97.785	0.003			15.5	μs	0.2	$5/2^+$	95			IT=100	
^{99}Tc	−87323.1	2.0					211.1	ky	1.2	$9/2^+$	01			β^-=100	
^{99}Tc^m	−87180.4	2.0	142.6832	0.0011			6.015	h	0.009	$1/2^-$	01			IT$\approx$100; β^-=0.0037 6	
^{99}Ru	−87617.0	2.0					STABLE			$5/2^+$	95			IS=12.76 14	
^{99}Rh	−85574	7					16.1	d	0.2	$(1/2^-)$	95			β^+=100	
^{99}Rh^m	−85510	7	64.3	0.4			4.7	h	0.1	$9/2^+$	95			$\beta^+\approx$100; IT<0.16	
^{99}Pd	−82188	15					21.4	m	0.2	$(5/2)^+$	95			β^+=100	
^{99}Ag	−76760	150					124	s	3	$(9/2)^+$	95			β^+=100	
^{99}Ag^m	−76250	150	506.1	0.4			10.5	s	0.5	$(1/2^-)$	95			IT=100	
^{99}Cd	−69850#	210#					16	s	3	$(5/2^+)$	95			β^+=100; β^+p=0.21 8;...	*
^{99}In	−61270#	400#					3.1	s	0.8	$9/2^+$#	97	01Ki13	TD	β^+=100; β^+p ?	
^{99}In^m	−60870#	430#	400#	150#			1#	s		$1/2^-$#				β^+ ?; IT ?	
^{99}Sn	−47200#	600#					5#	ms		$9/2^+$#				β^+ ?; β^+p ?	*
^{99}Sn^m	−46800#	610#	400#	100#						$1/2^-$#					

*^{99}Cd D : ... ; $\beta^+\alpha$<1e–4 **
*^{99}Sn I : the 3 events reported in 95Ry03 are not trusted by NUBASE **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{100}Kr	−36200#	500#					10#	ms	(>300 ns)	0^+	97	97Be70	I	β^- ?	
^{100}Rb	−46700#	300#					51	ms	8	(3^+)	97	93Ru01	D	β^-=100; β^-n=5.6 12;...	*
^{100}Sr	−60220	130					202	ms	3	0^+	97			β^-=100; β^-n=0.78 13	
^{100}Y	−67290	80				*	735	ms	7	$1^-,2^-$	97			β^-=100; β^-n=0.92 8	
^{100}Y^m	−67090#	220#	200#	200#		*	940	ms	30	$(3,4,5)^{+\#}$	97			β^-=100	
^{100}Zr	−76600	40					7.1	s	0.4	0^+	97			β^-=100	
^{100}Nb	−79939	26					1.5	s	0.2	1^+	97			β^-=100	
^{100}Nb^m	−79471	28	470	40	BD		2.99	s	0.11	$(4^+,5^+)$	97			β^-=100	
^{100}Mo	−86184	6					8.5	Ey	0.5	0^+	97	97Al02	T	IS=9.63 23; 2β^-=100	*
^{100}Tc	−86016.2	2.2					15.8	s	0.1	1^+	97			$\beta^-\approx$100; ε=0.0018 9	
^{100}Tc^m	−85815.5	2.2	200.67	0.04			8.32	μs	0.14	$(4)^+$	97				
^{100}Tc^n	−85772.2	2.2	243.96	0.04			3.2	μs	0.2	$(6)^+$	97				
^{100}Ru	−89219.0	2.0					STABLE			0^+	97			IS=12.60 7	
^{100}Rh	−85584	18					20.8	h	0.1	1^-	97			β^+=100	
^{100}Rh^m	−85476	18	107.6	0.2			4.6	m	0.2	(5^+)	97			IT$\approx$98.3; $\beta^+\approx$1.7	
^{100}Pd	−85226	11					3.63	d	0.09	0^+	97			ε=100	
^{100}Ag	−78150	80					2.01	m	0.09	$(5)^+$	97			β^+=100	
^{100}Ag^m	−78130	80	15.52	0.16			2.24	m	0.13	$(2)^+$	97			β^+=?; IT ?	
^{100}Cd	−74250	100					49.1	s	0.5	0^+	97			β^+=100	
^{100}Cd^m	−71700	100	2548.6	0.5			60	ns	3	$(8)^+$	97			IT=100	
^{100}In	−64170	250					5.9	s	0.2	$(6,7)^+$	97	02Pl03	TJ	β^+=100; β^+p>3.9	*
^{100}Sn	−56780	710					1.1	s	0.4	0^+	97			β^+=100; β^+p<17	*

*^{100}Rb D : . . . ; β^-2n=0.15 5 **
*^{100}Rb T : ENSDF average of 3 values. See also 53(2) of 85Pf.A J : from 95Pf04 **
*^{100}Rb D : β^-2n intensity is derived from β^-2n/β^-n=0.027(7), in 81Jo.A **
*^{100}Mo T : average 97Al02=7.6(+2.2–1.4) 97De40=6.82(+0.38–0.53 statistics + 0.68 systematics) **
*^{100}Mo T : 95Da37=9.5(0.9) 91Ej02=11.5(+3–2) and 91El04=11.6(+3.4–0.8) **
*^{100}In T : others: 95Sz01=6.1(0.9) 95Fa.A=6.3(+1.0–.9); 95Fa.A supersedes 95Sc33=7.8(.8) **
*^{100}Sn D : from 97Su06 β^+p/β^+<20% **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{101}Rb	−43600	170					32	ms	4	$3/2^+$#	98			β^-=100; β^-n=28 4	
^{101}Sr	−55410	120					118	ms	3	$(5/2^-)$	98			β^-=100; β^-n=2.37 14	
^{101}Y	−64910	100					426	ms	20	$(5/2^+)$	98	96Me09	T	β^-=100; β^-n=1.94 18	*
^{101}Zr	−73460	30					2.3	s	0.1	$3/2^+$	98	02Ca37	J	β^-=100	
^{101}Nb	−78942	19					7.1	s	0.3	$(5/2\#)^+$	98			β^-=100	
^{101}Mo	−83511	6					14.61	m	0.03	$1/2^+$	98			β^-=100	
^{101}Tc	−86336	24					14.22	m	0.01	$9/2^+$	98			β^-=100	
^{101}Tc^m	−86128	24	207.53	0.04			636	μs	8	$1/2^-$	98			IT=100	
^{101}Ru	−87949.7	2.0					STABLE			$5/2^+$	98			IS=17.06 2	
^{101}Ru^m	−87422.2	2.0	527.5	0.4			17.5	μs	0.4	$11/2^-$	98			IT=100	
^{101}Rh	−87408	17					3.3	y	0.3	$1/2^-$	98			ε=100	
^{101}Rh^m	−87251	17	157.32	0.04			4.34	d	0.01	$9/2^+$	98			ε=93.6 2; IT=6.4 2	
^{101}Pd	−85428	18					8.47	h	0.06	$5/2^+$	98			β^+=100	
^{101}Ag	−81220	100					11.1	m	0.3	$9/2^+$	98			β^+=100	
^{101}Ag^m	−80950	100	274.1	0.3			3.10	s	0.10	$1/2^-$	98			IT=100	
^{101}Cd	−75750	150					1.36	m	0.05	$(5/2^+)$	98			β^+=100	
^{101}In	−68610#	300#					15.1	s	1.1	$9/2^+$#	98			β^+=100; β^+p=?	
^{101}In^m	−68060#	320#	550#	100#			10#	s		$1/2^-$#				β^+=95#; IT=5#	
^{101}Sn	−59560#	300#					3	s	1	$5/2^+$#	98			β^+=100; β^+p=?	

*^{101}Y T : average 96Me09=400(20) 86Wa17=440(20) and 83Wo10=500(50) **
*^{101}Y T : 93Ru01=279(9) at variance, not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{102}Rb	−38310#	500#					37	ms	5		98			β^-=100; β^-n=18 8	
^{102}Sr	−53080	110					69	ms	6	0^+	98	93Ru01	D	β^-=100; β^-n=5.5 15	
^{102}Y	−61890	90				∗ &	300	ms	10	low	98			β^-=100; β^-n=4.9 12	
^{102}Y^m	−61690#	220#	200#	200#		∗ &	360	ms	40	high	98			β^-=100; β^-n=4.9 12	
^{102}Zr	−71740	50					2.9	s	0.2	0^+	98			β^-=100	
^{102}Nb	−76350	40					1.3	s	0.2	1^+	98			β^-=100	
^{102}Nb^m	−76220	50	130	50	BD		4.3	s	0.4	high	98			β^-=100	
^{102}Mo	−83557	21					11.3	m	0.2	0^+	01			β^-=100	
^{102}Tc	−84566	9				∗	5.28	s	0.15	1^+	98			β^-=100	
^{102}Tc^m	−84546	13	20	10		∗	4.35	m	0.07	$(4,5)$	98			β^-=98 2; IT=2 2	
^{102}Ru	−89098.0	2.0					STABLE			0^+	98			IS=31.55 14	
^{102}Rh	−86775	5					207.0	d	1.5	$(1^-,2^-)$	98	98Sh21	T	β^+=78 5; β^-=22 5	∗
^{102}Rh^m	−86634	5	140.75	0.08			3.742	y	0.010	6^+	98	98Sh21	T	$\beta^+\approx$100; IT=0.233 24	∗
^{102}Pd	−87925.1	3.0					STABLE			0^+	98			IS=1.02 1; 2β^+ ?	
^{102}Ag	−82265	28					12.9	m	0.3	5^+	98			β^+=100	
^{102}Ag^m	−82256	28	9.3	0.4			7.7	m	0.5	2^+	98			β^+=51 5; IT=49 5	
^{102}Cd	−79678	29					5.5	m	0.5	0^+	98			β^+=100	
^{102}In	−70710	110					23.3	s	0.1	(6^+)	98	03Gi06	T	β^+=100; β^+p=0.0093 13	∗
^{102}Sn	−64930	130					4.6	s	1.4	0^+	98	95Fa.A	T	β^+=100; β^+p ?	∗
^{102}Sn^m	−62910	130	2017	2			720	ns	220	(6^+)	98	98Li50	EJT	IT=100	∗

∗^{102}Rh T : average 98Sh21=207.3(1.7) 61Hi06=206(3) ∗∗
∗^{102}Rh^m J : from 99Gi14 ∗∗
∗^{102}In J : from 95Sz01 ∗∗
∗^{102}Sn T : 95Fa.A, supersedes 95Sc28=4.5(0.7), preliminary from same group ∗∗
∗^{102}Sn^m T : average 98Li50=620(+430–190) 97Gr02=300(+500–200) 96Li50=1000(500) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{103}Sr	−47550#	500#					50#	ms (>300 ns)			01	97Be70	I	β^- ?	
^{103}Y	−58940#	300#					224	ms	19	$5/2^+$#	01	96Me09	T	β^-=100; β^-n=8 3	∗
^{103}Zr	−68370	110					1.3	s	0.1	$(5/2^-)$	01			β^-=100	
^{103}Nb	−75320	70					1.5	s	0.2	$(5/2^+)$	01			β^-=100	
^{103}Mo	−80850	60					67.5	s	1.5	$(3/2^+)$	01			β^-=100	
^{103}Tc	−84597	10					54.2	s	0.8	$5/2^+$	01			β^-=100	
^{103}Ru	−87258.8	2.0					39.26	d	0.02	$3/2^+$	01			β^-=100	
^{103}Ru^m	−87020.6	2.1	238.2	0.7			1.69	ms	0.07	$11/2^-$	01			IT=100	
^{103}Rh	−88022.2	2.8					STABLE			$1/2^-$	01			IS=100.	
^{103}Rh^m	−87982.4	2.8	39.756	0.006			56.114	m	0.009	$7/2^+$	01			IT=100	
^{103}Pd	−87479.1	2.9					16.991	d	0.019	$5/2^+$	01			ε=100	
^{103}Pd^m	−86694.3	2.9	784.79	0.10			25	ns	2	$11/2^-$	01			IT=100	
^{103}Ag	−84791	17					65.7	m	0.7	$7/2^+$	01			β^+=100	
^{103}Ag^m	−84657	17	134.45	0.04			5.7	s	0.3	$1/2^-$	01			IT=100	
^{103}Cd	−80649	15					7.3	m	0.1	$5/2^+$	01			β^+=100	
^{103}In	−74599	25					60	s	1	$9/2^+$#	01	97Sz04	T	β^+=100	
^{103}In^m	−73967	25	631.7	0.1			34	s	2	$1/2^-$#	01	97Sz04	ETD	β^+=67; IT=33	
^{103}Sn	−66970#	300#					7	s	3	$5/2^+$#	01			β^+=100; β^+p=?	
^{103}Sb	−56180#	300#					100#	ms (>1.5 μs)		$5/2^+$#	01	95Ry03	I	β^+ ?	

∗^{103}Y T : average 96Me09=230(20) 96Lh04=190(50) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{104}Sr	−44400#	700#					30#	ms	(>300 ns)	0^+	00	97Be70	I	β^- ?	
^{104}Y	−54910#	400#					180	ms	60		00	99Wa09	D	β^-=100; β^-n=?	
^{104}Zr	−66340#	400#					1.2	s	0.3	0^+	00			β^-=100	
^{104}Nb	−72220	100				∗	4.9	s	0.3	(1^+)	00			β^-=100; β^-n=0.06 3	∗
^{104}Nb^m	−72010	100	220	120	BD	∗	940	ms	40	high	00			β^-=100; β^-n=0.05 3	
^{104}Mo	−80330	50					60	s	2	0^+	00			β^-=100	
^{104}Tc	−82490	50					18.3	m	0.3	3^+#	00			β^-=100	
^{104}Tc^m	−82420	50	69.7	0.2			3.5	μs	0.3	$2^{(+)}$	00			IT=100	
^{104}Ru	−88089	3					STABLE			0^+	00			IS=18.62 27; 2β^- ?	
^{104}Rh	−86949.8	2.8					42.3	s	0.4	1^+	00			$\beta^-\approx$100; β^+=0.45 10	
^{104}Rh^m	−86820.8	2.8	128.967	0.004			4.34	m	0.03	5^+	00			IT$\approx$100; β^-=0.13 1	
^{104}Pd	−89390	4					STABLE			0^+	00			IS=11.14 8	
^{104}Ag	−85111	6					69.2	m	1.0	5^+	00			β^+=100	
^{104}Ag^m	−85104	6	6.9	0.4			33.5	m	2.0	2^+	00			$\beta^+\approx$100; IT<0.07	
^{104}Cd	−83975	9					57.7	m	1.0	0^+	00			β^+=100	
^{104}In	−76110	80					1.80	m	0.03	$5,6^{(+)}$	00			β^+=100	
^{104}In^m	−76020	80	93.48	0.10			15.7	s	0.5	(3^+)	00			IT=80; β^+=20	
^{104}Sn	−71590	100					20.8	s	0.5	0^+	00			β^+=100	
^{104}Sb	−59180#	360#					470	ms	130		00	95Fa.A	D	β^+=?; β^+p<7; p<7; α ?	∗

∗^{104}Nb D : β^-n=0.71% of 83En03, at variance, not used ∗∗
∗^{104}Sb D : 95Fa.A supersedes 95Sc28 p<1 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{105}Sr	−38580#	700#					20#	ms	(>300 ns)		97	97Be70	I	β^- ?	
^{105}Y	−51350#	500#					60#	ms	(>300 ns)	$5/2^+$#	97	94Be24	I	β^- ?	
^{105}Zr	−62360#	400#					600	ms	100		97			β^-=100; β^-n ?	
^{105}Nb	−70850	100					2.95	s	0.06	$5/2^+$#	94	96Me09	D	β^-=100; β^-n=1.7 9	
^{105}Mo	−77340	70					35.6	s	1.6	$(5/2^-)$	93			β^-=100	
^{105}Tc	−82290	60					7.6	m	0.1	$(3/2^-)$	93			β^-=100	
^{105}Ru	−85928	3					4.44	h	0.02	$3/2^+$	93			β^-=100	
^{105}Rh	−87846	4					35.36	h	0.06	$7/2^+$	93			β^-=100	
^{105}Rh^m	−87716	4	129.781	0.004			45	s		$1/2^-$	93			IT=100	∗
^{105}Pd	−88413	4					STABLE			$5/2^+$	93			IS=22.33 8	
^{105}Ag	−87068	11					41.29	d	0.07	$1/2^-$	93			β^+=100	
^{105}Ag^m	−87043	11	25.465	0.012			7.23	m	0.16	$7/2^+$	93			IT$\approx$100; β^+=0.34 7	
^{105}Cd	−84330	12					55.5	m	0.4	$5/2^+$	93			β^+=100	
^{105}In	−79481	17					5.07	m	0.07	$9/2^+$	93	87Eb02	J	β^+=100	
^{105}In^m	−78807	17	674.1	0.3			48	s	6	$(1/2)^-$	93			IT=?; β^+=25#	
^{105}Sn	−73260	80					34	s	1	$(5/2^+)$	93	95Pf01	T	β^+=100; β^+p=?	∗
^{105}Sb	−63820	100					1.12	s	0.16	$(5/2^+)$	02			β^+ ?; p$\approx$1; β^+p ?	
^{105}Te	−52500#	500#					1#	μs		$5/2^+$#				α ?; β^+ ?	∗

∗^{105}Rh^m T : no error given; other value: 30 s (see ENSDF: remeasurement recommended) ∗∗
∗^{105}Sn J : from 85De08 ∗∗
∗^{105}Te I : the 3 events reported in 95Ry03 are not trusted by NUBASE ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{106}Y	−46770#	700#					50#	ms	(>300 ns)		97	97Be70	I	β^- ?	
^{106}Zr	−59700#	500#					200#	ms	(>300 ns)	0^+	97	94Be24	I	β^- ?	∗
^{106}Nb	−67100#	200#					920	ms	40	2^+#	94	96Me09	TD	β^-=100; β^-n=4.5 3	∗
^{106}Mo	−76255	18					8.73	s	0.12	0^+	94	95Jo02	T	β^-=100	
^{106}Tc	−79775	13					35.6	s	0.6	$(1,2)$	94			β^-=100	
^{106}Ru	−86322	8					373.59	d	0.15	0^+	94			β^-=100	
^{106}Rh	−86361	8					29.80	s	0.08	1^+	94			β^-=100	
^{106}Rh^m	−86225	11	136	12	BD		131	m	2	$(6)^+$	94			β^-=100	
^{106}Pd	−89902	4					STABLE			0^+	94			IS=27.33 3	
^{106}Ag	−86937	5					23.96	m	0.04	1^+	94			β^+=?; $\beta^-\approx$0.5	
^{106}Ag^m	−86847	5	89.66	0.07			8.28	d	0.02	6^+	94			β^+=100; IT$\leq$4.2e–6	

. . . A-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{106}Cd	−87132	6				STABLE		(>410 Ey)	0^+	94	02Tr04	T	IS=1.25 6; $2\beta^+$?	
^{106}In	−80606	12				6.2	m	0.1	7^+	94			β^+=100	
^{106}In^m	−80577	12	28.6	0.3		5.2	m	0.1	(3^+)	94			β^+=100	
^{106}Sn	−77430	50				1.92	m	0.08	0^+	94			β^+=100	
^{106}Sb	−66330#	310#				600	ms	200	(4^+)	97	94Se01	J	β^+=100	*
^{106}Sb^m	−65330#	590#	1000#	500#		220	ns	20			98Li50	T	IT=100	
^{106}Te	−58210	130				70	μs	20	0^+	94	94Pa11	T	α=100	*

*^{106}Zr I : and T>240 ns in 97So07 **
*^{106}Nb T : average 96Me09=900(20) 83Sh06=1020(50) **
*^{106}Sb T : from 95Le.C, Fig. 4, preliminary **
*^{106}Te T : average 94Pa11=60(+40–20) 81Sc17=60(+30–10) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{107}Y	−42720#	500#				30#	ms	(>300 ns)	$5/2^+$#	00	97Be70	I	β^- ?	
^{107}Zr	−55190#	300#				150#	ms	(>300 ns)		00	94Be24	I	β^- ?	*
^{107}Nb	−64920#	400#				300	ms	9	$5/2^+$#	00	96Me09	TD	β^-=100; β^-n=6.0 15	*
^{107}Mo	−72940	160				3.5	s	0.5	$(7/2^-)$	00			β^-=100	
^{107}Mo^m	−72870	160	66.3	0.2		470	ns	30	$(5/2^-)$	00			IT=100	
^{107}Tc	−79100	150				21.2	s	0.2	$(3/2^-)$	00			β^-=100	
^{107}Tc^m	−79030	150	65.7	1.0		184	ns	3	$(5/2^-)$	00			IT=100	
^{107}Ru	−83920	120				3.75	m	0.05	$(5/2)^+$	00			β^-=100	
^{107}Rh	−86863	12				21.7	m	0.4	$7/2^+$	00			β^-=100	
^{107}Rh^m	−86595	12	268.36	0.04		> 10	μs		$1/2^-$	00			IT=100	
^{107}Pd	−88368	4				6.5	My	0.3	$5/2^+$	00			β^-=100	
^{107}Pd^m	−88153	4	214.6	0.3		21.3	s	0.5	$11/2^-$	00			IT=100	
^{107}Ag	−88402	4				STABLE			$1/2^-$	00			IS=51.839 8	
^{107}Ag^m	−88309	4	93.125	0.019		44.3	s	0.2	$7/2^+$	00			IT=100	
^{107}Cd	−86985	6				6.50	h	0.02	$5/2^+$	00			β^+=100	
^{107}In	−83560	11				32.4	m	0.3	$9/2^+$	00			β^+=100	
^{107}In^m	−82882	11	678.5	0.3		50.4	s	0.6	$1/2^-$	00			IT=100	
^{107}Sn	−78580	80				2.90	m	0.05	$(5/2^+)$	00			β^+=100	
^{107}Sb	−70650#	300#				4.6	s	0.8	$5/2^+$#	00			β^+=100	
^{107}Te	−60540#	300#				3.1	ms	0.1	$5/2^+$#	00			α=70 30; β^+=30 30	

*^{107}Zr I : and T>240 ns in 97So07 **
*^{107}Nb T : average 96Me09=300(30) 91Hi02=300(10) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{108}Y	−37740#	800#				20#	ms	(>300 ns)		00	95Cz.A	I	β^- ?; β^-n ?	
^{108}Zr	−52200#	600#				80#	ms	(>300 ns)	0^+	00	97Be70	I	β^- ?; β^-n ?	
^{108}Nb	−60700#	300#				193	ms	17	(2^+)	00			β^-=100; β^-n=6.2 5	
^{108}Mo	−71300#	200#				1.09	s	0.02	0^+	00			β^-=100	
^{108}Tc	−75950	130				5.17	s	0.07	$(2)^+$	00			β^-=100	
^{108}Ru	−83670	120				4.55	m	0.05	0^+	00			β^-=100	
^{108}Rh	−85020	110			*	16.8	s	0.5	1^+	00			β^-=100	
^{108}Rh^m	−85080	40	−60	110	BD *	6.0	m	0.3	$(5)^{(+\#)}$	00			β^-=100	
^{108}Pd	−89524	3				STABLE			0^+	00			IS=26.46 9	
^{108}Ag	−87602	4				2.37	m	0.01	1^+	00			β^-=97.15 20; β^+=2.85 20	
^{108}Ag^m	−87493	4	109.440	0.007		418	y	21	6^+	00			β^+=91.3 9; IT=8.7 9	*
^{108}Cd	−89252	6				STABLE		(>410 Py)	0^+	02	95Ge14	T	IS=0.89 3; $2\beta^+$?	
^{108}In	−84116	10				58.0	m	1.2	7^+	00			β^+=100	
^{108}In^m	−84086	10	29.75	0.05		39.6	m	0.7	2^+	00			β^+=100	
^{108}Sn	−82041	20				10.30	m	0.08	0^+	00			β^+=100	
^{108}Sb	−72510#	210#				7.4	s	0.3	(4^+)	00			β^+=100; β^+p ?	
^{108}Te	−65720	100				2.1	s	0.1	0^+	00	85Ti02	D	β^+=51 4; α=49 4; . . .	*
^{108}I	−52650#	360#				36	ms	6	1^+#	00	94Pa12	D	α=?; β^+=9#; p<1	*

*^{108}Ag^m T : discrepant results: 418(7) 310(130) 127(21), see ENSDF **
*^{108}Te D : . . . ; β^+p=2.4 10; $\beta^+\alpha$<0.065 **
*^{108}I D : β^+=9%# estimated by 94Pa12 using theoretical β^+ half-life ≈400 ms **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{109}Zr	−47280#	500#				60#	ms	(>300 ns)		99	97Be70	I	β^- ?	
^{109}Nb	−58100#	500#				190	ms	30	$5/2^+$#	99			β^-=100; β^-n=31 5	
^{109}Mo	−67250#	300#				530	ms	60	$7/2^-$#	99			β^-=100	
^{109}Tc	−74540	100				860	ms	40	$3/2^-$#	99			β^-=100; β^-n=0.08 2	
^{109}Ru	−80850	70				34.5	s	1.0	$5/2^+$#	99			β^-=100	
^{109}Rh	−85011	12				80	s	2	$7/2^+$	99			β^-=100	
^{109}Pd	−87607	3				13.7012	h	0.0024	$5/2^+$	99			β^-=100	
^{109}Pd^m	−87418	3	188.990	0.010		4.696	m	0.003	$11/2^-$	99			IT=100	
^{109}Ag	−88722.7	2.9				STABLE			$1/2^-$	99			IS=48.161 8	
^{109}Ag^m	−88634.7	2.9	88.0341	0.0011		39.6	s	0.2	$7/2^+$	99			IT=100	
^{109}Cd	−88508	4				461.4	d	1.2	$5/2^+$	99			ε=100	
^{109}Cd^m	−88448	4	59.6	0.4		12	μs	2	$1/2^+$	99			IT=100	
^{109}Cd^n	−88045	4	463.0	0.5		10.9	μs	0.5	$11/2^-$	99			IT=100	
^{109}In	−86489	6				4.2	h	0.1	$9/2^+$	99			β^+=100	
^{109}In^m	−85839	6	650.1	0.3		1.34	m	0.07	$1/2^-$	99			IT=100	
^{109}In^n	−84387	6	2101.8	0.2		209	ms	6	$(19/2^+)$	99			IT=100	
^{109}Sn	−82639	10				18.0	m	0.2	$5/2^{(+)}$	99			β^+=100	
^{109}Sb	−76259	19				17.0	s	0.7	$5/2^+$#	99			β^+=100	
^{109}Te	−67610	60				4.6	s	0.3	$(5/2^+)$	99			β^+=?; α=3.9 13; . . .	*
^{109}I	−57610	100				103	μs	5	$(5/2^+)$	02	87Gi02	J	p=100	

*^{109}Te D : . . . ; β^+p=9.4 31; $\beta^+\alpha$<0.005 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{110}Zr	−43900#	800#				30#	ms	(>300 ns)	0^+	00	97Be70	I	β^- ?	
^{110}Nb	−53620#	500#				170	ms	20	2^+#	00			β^-=100; β^-n=40 8	
^{110}Mo	−65460#	400#				300	ms	40	0^+	00			β^-=100; β^-n ?	
^{110}Tc	−70960	80				920	ms	30	(2^+)	00	96Me09	D	β^-=100; β^-n=0.04 2	
^{110}Ru	−79980	50				11.6	s	0.6	0^+	00			β^-=100	
^{110}Rh	−82780	50			*	28.5	s	1.5	$(>3)^{(+\#)}$	00			β^-=100	
^{110}Rh^m	−82839	22	−60	50	BD *	3.2	s	0.2	1^+	00			β^-=100	
^{110}Pd	−88349	11				STABLE		(>600 Py)	0^+	00	52Wi26	T	IS=11.72 9; 2β^- ?	
^{110}Ag	−87460.6	2.9				24.6	s	0.2	1^+	00			β^-≈100; ε=0.30 6	
^{110}Ag^m	−87343.0	2.9	117.59	0.05		249.950	d	0.024	6^+	00	02Un02	T	β^-=98.64 6; IT=1.36 6	
^{110}Cd	−90353.0	2.7				STABLE			0^+	00			IS=12.49 18	
^{110}In	−86475	12				4.9	h	0.1	7^+	00			β^+=100	
^{110}In^m	−86413	12	62.1	0.5		69.1	m	0.5	2^+	00			β^+=100	
^{110}Sn	−85844	14				4.11	h	0.10	0^+	00			ε=100	
^{110}Sb	−77540#	200#				23.0	s	0.4	(4^+)	00	97La13	J	β^+=100	
^{110}Te	−72280	50				18.6	s	0.8	0^+	00			β^+≈100; α=0.003#	
^{110}I	−60320#	310#				650	ms	20	1^+#	00			β^+=83 4; α=17 4; . . .	*
^{110}Xe	−51900	130				310	ms	190	0^+	00	02Ma19	TD	α=64 35; β^+ ?	

*^{110}I D : . . . ; β^+p=11 3; $\beta^+\alpha$=1.1 3 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{111}Nb	−50630#	500#				80#	ms	(>300 ns)	$5/2^+$#	97	97Be70	I	β^- ?	
^{111}Mo	−61100#	400#				200#	ms	(>300 ns)		97	94Be24	I	β^- ?	*
^{111}Tc	−69220	110				290	ms	20	$3/2^-$#	96	96Me09	TD	β^-=100; β^-n=0.85 20	*
^{111}Ru	−76670	70				2.12	s	0.07	$(5/2^+)$	96	98Lh02	J	β^-=100	
^{111}Rh	−82357	30				11	s	1	$(7/2^+)$	96			β^-=100	
^{111}Pd	−86004	11				23.4	m	0.2	$5/2^+$	96			β^-=100	
^{111}Pd^m	−85832	11	172.18	0.08		5.5	h	0.1	$11/2^-$	96			IT=73 3; β^-=27 3	
^{111}Ag	−88221	3				7.45	d	0.01	$1/2^-$	96			β^-=100	
^{111}Ag^m	−88161	3	59.82	0.04		64.8	s	0.8	$7/2^+$	96			IT=99.3 2; β^-=0.7 2	
^{111}Cd	−89257.5	2.7				STABLE			$1/2^+$	00			IS=12.80 12	
^{111}Cd^m	−88861.3	2.7	396.214	0.021		48.50	m	0.09	$11/2^-$	00			IT=100	
^{111}In	−88396	5				2.8047	d	0.0004	$9/2^+$	00			ε=100	
^{111}In^m	−87859	5	536.95	0.06		7.7	m	0.2	$1/2^-$	00			IT=100	
^{111}Sn	−85945	7				35.3	m	0.6	$7/2^+$	96			β^+=100	
^{111}Sn^m	−85690	7	254.72	0.08		12.5	μs	1.0	$1/2^+$					
^{111}Sb	−80888	28				75	s	1	$(5/2^+)$	96			β^+=100	
^{111}Te	−73480	70				19.3	s	0.4	$5/2^+$#	97			β^+=100; β^+p=?	
^{111}I	−64950#	300#				2.5	s	0.2	$5/2^+$#	96			$\beta^+\approx$100; α=0.088	
^{111}I^m	−63550#	300#	1398	1		21	ns	2	$(11/2^-)$					
^{111}Xe	−54400#	300#				740	ms	200	$5/2^+$#	96	94Pa11	D	β^+ ?; α=10 7	
^{111}Xe^m			non existent		RN	900	ms	200			90Tu.A	T		*

*^{111}Mo I : and T>240 ns in 97So07 **
*^{111}Tc T : supersedes 88Pe13=300(30) from same group **
*^{111}Xe^m I : from assigning α decay to isomer in older version of ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{112}Nb	−45800#	700#				60#	ms	(>300 ns)	2^+#	97	97Be70	I	β^- ?	
^{112}Mo	−58830#	600#				150#	ms	(>300 ns)	0^+	97	94Be24	I	β^- ?	
^{112}Tc	−66000	120				290	ms	20	2^+#	97	99Wa09	TD	β^-=100; β^-n=1.5 2	
^{112}Ru	−75480	70				1.75	s	0.07	0^+	97			β^-=100	
^{112}Rh	−79740	50				3.4	s	0.4	1^+	97	99Lh01	T	β^-=100	*
^{112}Rh^m	−79410	60	330	70	BD	6.73	s	0.15	>3	97	99Lh01	T	β^-=100	*
^{112}Pd	−86336	18				21.03	h	0.05	0^+	97			β^-=100	
^{112}Ag	−86624	17				3.130	h	0.009	$2^{(-)}$	97			β^-=100	
^{112}Cd	−90580.5	2.7				STABLE			0^+	97			IS=24.13 21	
^{112}In	−87996	5				14.97	m	0.10	1^+	97			β^+=56 3; β^-=44 3	
^{112}In^m	−87839	5	156.59	0.05		20.56	m	0.06	4^+	97			IT=100	
^{112}In^n	−87645	5	350.76	0.09		690	ns	50	7^+	97			IT=100	
^{112}In^p	−87382	5	613.69	0.14		2.81	μs	0.03	8^-	97	87Eb02	J	IT=100	
^{112}Sn	−88661	4				STABLE			0^+	97			IS=0.97 1; 2β^+ ?	
^{112}Sb	−81601	18				51.4	s	1.0	3^+	97			β^+=100	
^{112}Te	−77300	170				2.0	m	0.2	0^+	97			β^+=100	
^{112}I	−67100#	210#				3.42	s	0.11	1^+#	97	78Ro19	D	$\beta^+\approx$100; α=0.0012; ...	*
^{112}Xe	−59970	100				2.7	s	0.8	0^+	97	94Pa11	D	$\beta^+\approx$100; α=0.9 8	*
^{112}Cs	−46290#	300#				500	μs	100	1^+#	02			p=100	

*^{112}Rh T : supersedes 91Jo11=2.1(0.3) and 88Ay02=3.8(0.6) of same group **
*^{112}Rh^m T : supersedes 88Ay02=6.8(0.2) **
*^{112}I D : ... ; β^+p=0.88 10; $\beta^+\alpha$=0.104 12 **
*^{112}I D : β^+p and $\beta^+\alpha$ are derived from β^+p/α=735(80) β^+p/$\beta^+\alpha$=8.5(2), in 85Ti02 **
*^{112}Xe D : α intensity is estimated from 94Pa11=0.8(+1.1–0.5)% and 78Ro19=0.84% **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{113}Nb	−42200#	800#					30#	ms	(>300 ns)	$5/2^+$#	98	97Be70	I	β^- ?	
^{113}Mo	−54140#	600#					100#	ms	(>300 ns)		98	94Be24	I	β^- ?	
^{113}Tc	−63720#	300#					170	ms	20	$3/2^-$#	98	99Wa09	TD	β^-=100; β^-n=2.1 3	*
^{113}Ru	−72200	70					800	ms	50	$(5/2^+)$	98	98Ku17	J	β^-=100	
^{113}Ru^m	−72070	70	130	18			510	ms	30	$(11/2^-)$		98Ku17	ETJ	IT=?; β^-=?	*
^{113}Rh	−78680	50					2.80	s	0.12	$(7/2^+)$	98	93Pe11	J	β^-=100	
^{113}Pd	−83690	40					93	s	5	$(5/2^+)$	98			β^-=100	
^{113}Pd^m	−83610	40	81.1	0.3			300	ms	100	$(9/2^-)$	98			IT=100	
^{113}Pd^n			non existent		RN		>100	s			98	81Me17	I		*
^{113}Ag	−87033	17					5.37	h	0.05	$1/2^-$	98			β^-=100	
^{113}Ag^m	−86990	17	43.50	0.10			68.7	s	1.6	$7/2^+$	98			IT=64 7; β^-=36 7	
^{113}Cd	−89049.3	2.7					7.7	Py	0.3	$1/2^+$	98			IS=12.22 12; β^-=100	
^{113}Cd^m	−88785.8	2.7	263.54	0.03			14.1	y	0.5	$11/2^-$	98			$\beta^-\approx$100; IT=0.14	
^{113}In	−89370	3					STABLE			$9/2^+$	99			IS=4.29 5	
^{113}In^m	−88978	3	391.699	0.003			1.6579	h	0.0004	$1/2^-$	99			IT=100	
^{113}Sn	−88333	4					115.09	d	0.03	$1/2^+$	00			β^+=100	
^{113}Sn^m	−88256	4	77.386	0.019			21.4	m	0.4	$7/2^+$	00			IT=91.1 23; β^+=8.9 23	
^{113}Sb	−84420	18					6.67	m	0.07	$5/2^+$	98			β^+=100	
^{113}Te	−78347	28					1.7	m	0.2	$(7/2^+)$	98			β^+=100	
^{113}I	−71130	50					6.6	s	0.2	$5/2^+$#	98			β^+=100; α=3.31e–7; …	*
^{113}Xe	−62090	80					2.74	s	0.08	$5/2^+$#	98	85Ti02	D	$\beta^+\approx$100; α=0.011 5; …	*
^{113}Cs	−51700	100					16.7	μs	0.7	$5/2^+$#	02			p=100; α=0	

*^{113}Tc T : 98Ku17=110(30) and 92Ay02=130(50) are from same authors **
*^{113}Ru^m E : above the 99 keV level and below 160 keV **
*^{113}Pd^n I : existence is not possible since discovery of ^{113}Pd^m by 93Pe11 **
*^{113}I D : … ; $\beta^+\alpha$? **
*^{113}Xe D : … ; β^+p=7 4; $\beta^+\alpha\approx$0.007 4 **
*^{113}Xe D : α=0.0024-0.0204% from estimated limit for the reduced width, see 85Ti02 **
*^{113}Xe D : β^+p and $\beta^+\alpha$ derived from β^+p/α=605(35) and β^+p/$\beta^+\alpha$=500-1500 in 85Ti02 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{114}Mo	−51310#	700#					80#	ms	(>300 ns)	0^+	03	97Be70	I	β^- ?	
^{114}Tc	−59730#	600#					150	ms	30	2^+#	03			β^-=100; β^-n=?	
^{114}Ru	−70530#	230#					530	ms	60	0^+	03			β^-=100; β^-n ?	
^{114}Rh	−75630	110				*	1.85	s	0.05	1^+	03			β^-=100; β^-n ?	
^{114}Rh^m	−75430#	190#	200#	150#		*	1.85	s	0.05	$(4,5)$	03			β^-=100	
^{114}Pd	−83497	24					2.42	m	0.06	0^+	03			β^-=100	
^{114}Ag	−84949	25					4.6	s	0.1	1^+	03			β^-=100	
^{114}Ag^m	−84750	25	199	5			1.50	ms	0.05	$(<7^+)$	03			IT=100	
^{114}Cd	−90020.9	2.7					STABLE		(>92 Py)	0^+	03	95Ge14	T	IS=28.73 42; 2β^- ?	
^{114}In	−88572	3					71.9	s	0.1	1^+	03			β^-=99.50 15; β^+=0.50 15	
^{114}In^m	−88382	3	190.29	0.03			49.51	d	0.01	5^+	03			IT=96.75 24; β^+=3.25 24	
^{114}In^n	−88070	3	501.94	0.03			43.1	ms	0.6	(8^-)	03			IT=100	
^{114}In^p	−87930	3	641.72	0.03			4.3	μs	0.4	(7^+)	03			IT=100	
^{114}Sn	−90561	3					STABLE			0^+	03			IS=0.66 1	
^{114}Sn^m	−87474	3	3087.37	0.07			733	ns	14	7^-	03			IT=100	
^{114}Sb	−84515	28					3.49	m	0.03	(3^+)	03			β^+=100	
^{114}Sb^m	−84020	28	495.5	0.07			219	μs	12	(8^-)	03			IT=100	
^{114}Te	−81889	28					15.2	m	0.7	0^+	03			β^+=100	
^{114}I	−72800#	300#					2.1	s	0.2	1^+	03			β^+=100; β^+p ?	
^{114}I^m	−72530#	300#	265.9	0.5			6.2	s	0.5	(7)	03	ABBW96	D	β^+=91 2; IT=9 2	*
^{114}Xe	−67086	11					10.0	s	0.4	0^+	03			β^+=100	
^{114}Cs	−54540#	310#					570	ms	20	(1^+)	03			$\beta^+\approx$100; α=0.018 6; …	*
^{114}Ba	−45950	140					530	ms	230	0^+	03	02Ma19	D	$\beta^+\approx$100; β^+p=20 10; …	*

*^{114}I^m D : evaluated for NUBASE by J. Blachot, based on ^{114}I IT decay **
*^{114}Cs D : … ; β^+p=8.7 13; $\beta^+\alpha$=0.19 3 **
*^{114}Ba D : … ; α=0.9 3; ^{12}C<0.038 **
*^{114}Ba D : ^{12}C intensity is from 95Gu10 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{115}Mo	−46310#	800#					60#	ms	(>300 ns)		99			β^- ?; β^-n ?	
^{115}Tc	−57110#	700#					100#	ms	(>300 ns)	$3/2^-$#	99			β^- ?; β^-n ?	
^{115}Ru	−66430	130					740	ms	80		99			β^-=100; β^-n ?	
^{115}Rh	−74210	80					990	ms	50	$7/2^+$#	99			β^-=100	
^{115}Pd	−80400	60					25	s	2	$5/2^+$#	99			β^-=100	
^{115}Pd^m	−80310	60	89.18	0.25			50	s	3	$11/2^-$#	99			β^-=92.0 20; IT=8.0 20	*
^{115}Ag	−84990	30					20.0	m	0.5	$1/2^-$	99			β^-=100	
^{115}Ag^m	−84950	30	41.16	0.10			18.0	s	0.7	$7/2^+$	99			β^-=79.0 3; IT=21.0 3	
^{115}Cd	−88090.5	2.7					53.46	h	0.10	$1/2^+$	99			β^-=100	
^{115}Cd^m	−87909.5	2.7	181.0	0.5			44.56	d	0.24	$(11/2)^-$	99			$\beta^-\approx$100; IT<0.003	
^{115}In	−89537	4					441	Ty	25	$9/2^+$	99			IS=95.71 5; β^-=100	
^{115}In^m	−89201	4	336.244	0.017			4.486	h	0.004	$1/2^-$	99			IT=95.0 7; β^-=5.0 7	
^{115}Sn	−90036.0	2.9					STABLE			$1/2^+$	99			IS=0.34 1	
^{115}Sn^m	−89423.2	2.9	612.81	0.04			3.26	μs	0.08	$7/2^+$	99			IT=100	
^{115}Sn^n	−89322.4	2.9	713.64	0.12			159	μs	1	$11/2^-$	99			IT=100	
^{115}Sb	−87003	16					32.1	m	0.3	$5/2^+$	99			β^+=100	
^{115}Te	−82063	28				*	5.8	m	0.2	$7/2^+$	99			β^+=100	
^{115}Te^m	−82053	29	10	7		*	6.7	m	0.4	$(1/2)^+$	99	ABBW	E	$\beta^+\approx$100; IT<0.06	*
^{115}Te^n	−81783	28	280.05	0.20			7.5	μs	0.2	$11/2^-$	99			IT=100	
^{115}I	−76338	29					1.3	m	0.2	$5/2^+$#	99			β^+=100	
^{115}Xe	−68657	12					18	s	4	$(5/2^+)$	99			β^+=100; β^+p=0.34 6; …	*
^{115}Cs	−59700#	300#					1.4	s	0.8	$9/2^+$#	99			β^+=100; β^+p$\approx$0.07	
^{115}Ba	−49030#	600#					450	ms	50	$5/2^+$#	99	97Ja12	D	β^+=100; β^+p>15	

*^{115}Pd^m J : E3 transition to ground-state **
*^{115}Te^m E : less than 20 keV, from ENSDF **
*^{115}Xe D : . . . ; $\beta^+\alpha$=0.0003 1 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{116}Tc	−52750#	700#					90#	ms	(>300 ns)	2^+#	01	97Be70	I	β^- ?	
^{116}Ru	−64450#	700#					400#	ms	(>300 ns)	0^+	01	94Be24	I	β^- ?	*
^{116}Rh	−70740	140				*	680	ms	60	1^+	01			β^-=100; β^-n ?	
^{116}Rh^m	−70540#	210#	200#	150#		*	570	ms	50	(6^-)	01			β^-=100	
^{116}Pd	−79960	60					11.8	s	0.4	0^+	01			β^-=100	
^{116}Ag	−82570	50					2.68	m	0.10	$(2)^-$	01			β^-=100	
^{116}Ag^m	−82490	50	81.90	0.20			8.6	s	0.3	(5^+)	01			β^-=94.0 15; IT=6.0 15	
^{116}Cd	−88719	3					30	Ey	4	0^+	01	03Da09	T	IS=7.49 18; 2β^-=100	*
^{116}In	−88250	4					14.10	s	0.03	1^+	01	98Bh04	D	$\beta^-\approx$100; ε=0.23 6	
^{116}In^m	−88123	4	127.267	0.006			54.29	m	0.17	5^+	01			β^-=100	
^{116}In^n	−87960	4	289.660	0.006			2.18	s	0.04	8^-	01			IT=100	
^{116}Sn	−91528.1	2.9					STABLE			0^+	01			IS=14.54 9	
^{116}Sb	−86821	6					15.8	m	0.8	3^+	01			β^+=100	
^{116}Sb^m	−86440	40	380	40	BD		60.3	m	0.6	8^-	01			β^+=100	
^{116}Te	−85269	28					2.49	h	0.04	0^+	01			β^+=100	
^{116}I	−77490	100					2.91	s	0.15	1^+	01			β^+=100	
^{116}I^m	−77090#	110#	400#	50#			3.27	μs	0.16	(7^-)	01			IT=100	
^{116}Xe	−73047	13					59	s	2	0^+	01			β^+=100	
^{116}Cs	−62070#	100#				*	700	ms	40	(1^+)	01			β^+=100; β^+p=0.28 7;...	*
^{116}Cs^m	−61970#	120#	100#	60#		*	3.85	s	0.13	$4^+,5,6$	01			β^+=100; β^+p=0.51 15;...	*
^{116}Ba	−54600#	400#					1.3	s	0.2	0^+	01			β^+=100; β^+p=3 1	

*^{116}Ru I : and T>240 ns in 97So07 **
*^{116}Cd T : from 29(1 statistics +4–3 systematics); supersedes 00Da27=26(1 statistics +7–4 systematics) **
*^{116}Cs D : . . . ; $\beta^+\alpha$=0.049 25 **
*^{116}Cs^m D : . . . ; $\beta^+\alpha$=0.008 2 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{117}Tc	−49850#	700#					40#	ms (>300 ns)		$3/2^-$#	02	97Be70	I	β^- ?	
^{117}Ru	−60010#	700#					300#	ms (>300 ns)			02	94Be24	I	β^- ?	*
^{117}Rh	−68950#	500#					440	ms	40	$7/2^+$#	02			β^-=100	
^{117}Pd	−76530	60					4.3	s	0.3	$(5/2^+)$	02			β^-=100	
^{117}Pd^m	−76330	60	203.2	0.3			19.1	ms	0.7	$11/2^-$#	02			IT=100	
^{117}Ag	−82270	50					73.6	s	1.4	$1/2^-$#	02			β^-=100	
^{117}Ag^m	−82240	50	28.6	0.2			5.34	s	0.05	$(7/2^+)$	02			β^-=94.0 15; IT=6.0 15	
^{117}Cd	−86425	3					2.49	h	0.04	$1/2^+$	02			β^-=100	
^{117}Cd^m	−86289	3	136.4	0.2			3.36	h	0.05	$(11/2)^-$	02			$\beta^-\approx$100; IT$\approx$0	
^{117}In	−88945	6					43.2	m	0.3	$9/2^+$	02			β^-=100	
^{117}In^m	−88630	6	315.302	0.012			116.2	m	0.3	$1/2^-$	02			β^-=52.9 15; IT=47.1 15	
^{117}Sn	−90400.0	2.9					STABLE			$1/2^+$	02			IS=7.68 7	
^{117}Sn^m	−90085.4	2.9	314.58	0.04			13.76	d	0.04	$11/2^-$	02			IT=100	
^{117}Sb	−88645	9					2.80	h	0.01	$5/2^+$	02			β^+=100	
^{117}Te	−85097	13					62	m	2	$1/2^+$	02			β^+=100; e$^+$=25 1	
^{117}Te^m	−84801	13	296.1	0.5			103	ms	3	$(11/2^-)$	02	99Mo30	J	IT ?	
^{117}Te^n	−84823	13	274.4	0.1			19.9	ns	0.4	$5/2^+$	02			IT=100	
^{117}I	−80435	28					2.22	m	0.04	$(5/2)^+$	02			β^+=100; e$^+\approx$77	
^{117}Xe	−74185	10					61	s	2	$5/2^{(+)}$	02			β^+=100; β^+p=0.0029 6	
^{117}Cs	−66440	60				*	8.4	s	0.6	$9/2^+$#	02			β^+=100	
^{117}Cs^m	−66290#	100#	150#	80#		*	6.5	s	0.4	$3/2^+$#	02			β^+=100	
^{117}Cs^x	−66390	80	50	50			R =?			spmix					
^{117}Ba	−57290#	300#					1.75	s	0.07	$(3/2)^{(+\#)}$	02	97Ja12	D	β^+=100; β^+p=13 3; …	*
^{117}La	−46510#	400#					23.5	ms	2.6	$(3/2^+,3/2^-)$	02			p=?; β^+=6#	
^{117}La^m	−46370#	400#	138	15	p		10	ms	5	$(9/2^+)$	02			p=?; β^+=3#	

*^{117}Ru I : and T>240 ns in 97So07 **
*^{117}Ba D : … ; $\beta^+\alpha$=0.024 8 **
*^{117}Ba D : β^+p from 97Ja12. β^+p/$\beta^+\alpha$=350-1200 from 85Ti02 yields $\beta^+\alpha$=0.011-0.037 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{118}Tc	−45200#	900#					30#	ms (>300 ns)		2^+#	97	95Cz.A	I	β^- ?	
^{118}Ru	−57920#	800#					200#	ms (>300 ns)		0^+		94Be24	I	β^- ?	
^{118}Rh	−65140#	500#					310	ms	30	$(4^-10)^{(+\#)}$	97	00Jo18	TJD	β^-=100	
^{118}Pd	−75470	210					1.9	s	0.1	0^+	95			β^-=100	
^{118}Ag	−79570	60					3.76	s	0.15	1^-	95	93Ja03	J	β^-=100	
^{118}Ag^m	−79440	60	127.49	0.05			2.0	s	0.2	$4^{(+)}$	95	95Ap.A	E	β^-=59; IT=41	
^{118}Cd	−86709	20					50.3	m	0.2	0^+	95			β^-=100	
^{118}In	−87230	8				*	5.0	s	0.5	1^+	95			β^-=100	
^{118}In^m	−87130#	50#	100#	50#		*	4.364	m	0.007	5^+	95	94It.A	T	β^-=100	
^{118}In^n	−86990#	50#	240#	50#			8.5	s	0.3	8^-	95			IT=98.6 3; β^-=1.4 3	*
^{118}Sn	−91656.1	2.9					STABLE			0^+	95			IS=24.22 9	
^{118}Sb	−87999	4					3.6	m	0.1	1^+	95			β^+=100	
^{118}Sb^m	−87749	6	250	6	BD		5.00	h	0.02	8^-	95			β^+=100	
^{118}Sb^n	−87948	4	50.814	0.021			20.6	μs	0.6	$(3)^+$					
^{118}Te	−87721	15					6.00	d	0.02	0^+	95			ε=100	
^{118}I	−80971	20					13.7	m	0.5	2^-	95			β^+=100	
^{118}I^m	−80781	20	190.1	1.0			8.5	m	0.5	(7^-)	95	94Ka39	E	$\beta^+\approx$100; IT=?	
^{118}Xe	−78079	10					3.8	m	0.9	0^+	95			β^+=100	
^{118}Cs	−68409	13				*	14	s	2	2	95			β^+=100; β^+p=0.021 14;...	*
^{118}Cs^m	−68310#	60#	100#	60#		*	17	s	3	(7^-)	95	93Be46	J	β^+=100; β^+p=0.021 14;...	*
^{118}Cs^x	−68404	12	5	4			$R<0.1$			spmix					
^{118}Ba	−62370#	200#					5.2	s	0.2	0^+	97	97Ja12	TD	β^+=100; β^+p ?	
^{118}La	−49620#	300#					200#	ms						β^+ ?	

*^{118}In^n E : 138.2(0.5) keV above ^{118}In^m, from ENSDF **
*^{118}Cs D : … ; $\beta^+\alpha$=0.0012 5 **
*^{118}Cs D : derived from β^+p=0.042(6)%, $\beta^+\alpha$=0.0024(4)% for mixture of ground-state and isomer. **
*^{118}Cs D : Replaced by uniform distributions from zero to values for each isomer **
*^{118}Cs^m D : … ; $\beta^+\alpha$=0.0012 5 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
^{119}Ru	−53240#	700#				170#	ms (>300 ns)				97Be70 I	β^- ?	
^{119}Rh	−63240#	600#				300#	ms (>300 ns)		$7/2^+$#		94Be24 I	β^- ?	
^{119}Pd	−71620#	300#				920	ms	130		00		β^-=100	
^{119}Ag	−78560	90			∗&	6.0	s	0.5	$1/2^-$#	00		β^-=100	
^{119}Ag^m	−78540#	90#	20#	20#	∗&	2.1	s	0.1	$7/2^+$#	00		β^-=100	∗
^{119}Cd	−83910	80				2.69	m	0.02	$(3/2^+)$	00		β^-=100	
^{119}Cd^m	−83760	80	146.54	0.11		2.20	m	0.02	$11/2^-$#	00		β^-=100	
^{119}In	−87704	8				2.4	m	0.1	$9/2^+$	00		β^-=100	
^{119}In^m	−87393	8	311.37	0.03		18.0	m	0.3	$1/2^-$	00		β^-=94.4 15; IT=5.6 15	
^{119}Sn	−90068.4	2.9				STABLE			$1/2^+$	00		IS=8.59 4	
^{119}Sn^m	−89978.9	2.9	89.531	0.013		293.1	d	0.7	$11/2^-$	00		IT=100	
^{119}Sb	−89477	8				38.19	h	0.22	$5/2^+$	00		ε=100	
^{119}Sb^m	−86625	11	2852	7		850	ms	90	$27/2^+$#	00	ABBW E	IT=100	∗
^{119}Te	−87184	8				16.05	h	0.05	$1/2^+$	00		β^+=100	
^{119}Te^m	−86923	8	260.96	0.05		4.70	d	0.04	$11/2^-$	00		ε=99.59 4; e$^+$=0.41 4; ...	∗
^{119}I	−83766	28				19.1	m	0.4	$5/2^+$	00		β^+=100	
^{119}Xe	−78794	10				5.8	m	0.3	$5/2^{(+)}$	00	90Ne.A J	e$^+$=79 5; ε=21 5	
^{119}Cs	−72305	14			∗	43.0	s	0.2	$9/2^+$	00		β^+=100; $\beta^+\alpha$<2e–6	
^{119}Cs^m	−72260#	30#	50#	30#	∗	30.4	s	0.1	$3/2^{(+)}$	00		β^+=100	
^{119}Cs^x	−72289	9	16	11		R = .5 .25			spmix				
^{119}Ba	−64590	200				5.4	s	0.3	$(5/2^+)$	00		β^+=100; β^+p<25	
^{119}La	−54970#	400#				1#	s		$11/2^-$#			β^+ ?	
^{119}Ce	−44000#	600#				200#	ms		$5/2^+$#			β^+ ?	

∗^{119}Ag^m E : estimated from 7/2$^+$ level in isotopes ^{113}Ag=43 ^{115}Ag=41 ^{117}Ag=28 ∗∗
∗^{119}Sb^m E : estimated less than 20 keV above 2841.7 level ∗∗
∗^{119}Te^m D : ...; IT<0.008 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
^{120}Ru	−50940#	800#				80#	ms (>300 ns)		0^+	02	95Cz.A I	β^- ?	
^{120}Rh	−59230#	600#				200#	ms (>300 ns)				94Be24 I	β^- ?	
^{120}Pd	−70150	120				500	ms	100	0^+	02		β^-=100	
^{120}Ag	−75650	70				1.23	s	0.04	$3^{(+\#)}$	02	93Ru01 D	β^-=100; β^-n<0.003	
^{120}Ag^m	−75450	70	203.0	1.0		371	ms	24	$6^{(-)}$	02	03Wa13 T	β^-≈63; IT≈37	∗
^{120}Cd	−83974	19				50.80	s	0.21	0^+	02		β^-=100	
^{120}In	−85740	40			∗	3.08	s	0.08	1^+	02		β^-=100	
^{120}In^m	−85690#	50#	50#	60#	∗&	46.2	s	0.8	5^+	02	87Eb02 J	β^-=100	
^{120}In^n	−85440#	200#	300#	200#	∗&	47.3	s	0.5	$8^{(-)}$	02	79Fo10 J	β^-=100	
^{120}Sn	−91105.1	2.5				STABLE			0^+	02		IS=32.58 9	
^{120}Sn^m	−88623.5	2.5	2481.63	0.06		11.8	μs	0.5	(7^-)	02		IT=100	
^{120}Sn^n	−88202.9	2.5	2902.22	0.22		6.26	μs	0.11	10^+#	02		IT=100	
^{120}Sb	−88424	8			∗	15.89	m	0.04	1^+	02		β^+=100	
^{120}Sb^m	−88420#	100#	0#	100#	∗	5.76	d	0.02	8^-	02		β^+=100	
^{120}Sb^n	−88346	8	78.16	0.05		246	ns	2	(3^+)	02		IT=100	
^{120}Sb^p	−86096	8	2328.3	0.6		400	ns	8	(6)	02		IT=100	
^{120}Te	−89405	10				STABLE			0^+	02		IS=0.09 1; 2β^+ ?	
^{120}I	−83790	18				81.6	m	0.2	2^-	02		β^+=100	
^{120}I^m	−83717	18	72.61	0.09		228	ns	15	$(1^+,2^+,3^+)$	02		IT=100	
^{120}I^n	−83470	23	320	15		53	m	4	(7^-)	02		β^+=100	
^{120}Xe	−82172	12				40	m	1	0^+	02		β^+=100	
^{120}Cs	−73889	10			∗	61.2	s	1.8	$2^{(-\#)}$	02		β^+=100; $\beta^+\alpha$<2.0e–5 4;...	∗
^{120}Cs^m	−73790#	60#	100#	60#	∗	57	s	6	(7^-)	02	75Ho09 D	β^+=100; $\beta^+\alpha$<2.0e–5 4;...	∗
^{120}Cs^x	−73884	9	5	4		$R < 0.1$			spmix				
^{120}Ba	−68890	300				24	s	2	0^+	02	92Xu04 T	β^+=100	
^{120}La	−57690#	500#				2.8	s	0.2		02		β^+=100; β^+p=?	
^{120}Ce	−49710#	700#				250#	ms		0^+			β^+ ?	

∗^{120}Ag^m T : average 03Wa13=400(30) 71Fo22=320(40) ∗∗
∗^{120}Cs D : ...; β^+p<7e–6 3 ∗∗
∗^{120}Cs D : isomers not distinguished by 75Ho09 in $\beta^+\alpha$ and β^+p. Values replaced ∗∗
∗^{120}Cs D : by upper limits for both (cf. ENSDF evaluation of ^{118}Cs) ∗∗
∗^{120}Cs^m D : ...; β^+p<7e–6 3 ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{121}Rh	−57080#	900#				100#	ms (>300 ns)		$7/2^{+}$#		94Be24	I	β^{-} ?	
^{121}Pd	−66260#	500#				400#	ms (>300 ns)			00	94Be24	I	β^{-} ?	*
^{121}Ag	−74660	150				790	ms	20	$7/2^{+}$#	00			β^{-}=100; β^{-}n=0.080 13	
^{121}Cd	−81060	80				13.5	s	0.3	$(3/2^{+})$	00			β^{-}=100	
^{121}Cd^{m}	−80850	80	214.86	0.15		8.3	s	0.8	$(11/2^{-})$	00			β^{-}=100	
^{121}In	−85841	27				23.1	s	0.6	$9/2^{+}$	00			β^{-}=100	
^{121}In^{m}	−85528	27	312.98	0.08		3.88	m	0.10	$1/2^{-}$	00			β^{-}=98.8 2; IT=1.2 2	
^{121}Sn	−89204.1	2.5				27.03	h	0.04	$3/2^{+}$	00			β^{-}=100	
^{121}Sn^{m}	−89197.8	2.5	6.30	0.06		43.9	y	0.5	$11/2^{-}$	00	02Re18	T	IT=77.6 20; β^{-}=22.4 20	
^{121}Sn^{n}	−87205.3	2.7	1998.8	0.9		5.3	μs	0.5	$19/2^{+}$#	00			IT=100	
^{121}Sb	−89595.1	2.2				STABLE			$5/2^{+}$	00			IS=57.21 5	
^{121}Te	−88551	26				19.16	d	0.05	$1/2^{+}$	00			β^{+}=100	
^{121}Te^{m}	−88257	26	293.991	0.022		154	d	7	$11/2^{-}$	00			IT=88.6 11; β^{+}=11.4 11	
^{121}I	−86287	10				2.12	h	0.01	$5/2^{+}$	00			β^{+}=100	
^{121}I^{m}	−83910	10	2376.9	0.4		9.0	μs	1.5		00			IT=100	
^{121}Xe	−82473	11				40.1	m	2.0	$(5/2^{+})$	00			β^{+}=100	
^{121}Cs	−77100	14				155	s	4	$3/2^{(+)}$	00			β^{+}=100	
^{121}Cs^{m}	−77032	14	68.5	0.3		122	s	3	$9/2^{(+)}$	00			β^{+}=83; IT=17	
^{121}Ba	−70740	140				29.7	s	1.5	$5/2^{(+)}$	00			β^{+}=100; β^{+}p=0.02 1	
^{121}La	−62400#	500#				5.3	s	0.2	$11/2^{-}$#	00			β^{+}=100; β^{+}p ?	
^{121}Ce	−52700#	500#				1.1	s	0.1	$(5/2)^{(+\#)}$	00	99Li46	J	β^{+}=100; β^{+}p≈1	
^{121}Pr	−41580#	700#				600	ms	300	$(3/2^{-})$	00	90Bo39	TJD	p=?; β^{+} ?; β^{+}p ?	*

*^{121}Pd I : and T>240 ns in 97So07 **
*^{121}Pr T : T=1.4(0.8) s in ENSDF: not trusted to belong to this nuclide **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{122}Rh	−52900#	700#					50#	ms (>300 ns)				97Be70	I	β^{-} ?	
^{122}Pd	−64690#	400#					300#	ms (>300 ns)		0^{+}	98	94Be24	I	β^{-} ?	*
^{122}Ag	−71230#	210#				*	520	ms	14	(3^{+})	94	95Fe12	T	β^{-}=100; β^{-}n=0.186 10	*
^{122}Ag^{m}	−71150#	220#	80#	50#		*	1.5	s	0.5	8^{-}#	94			β^{-}=100; β^{-}n ?	
^{122}Cd	−80730	40					5.24	s	0.03	0^{+}	94			β^{-}=100	
^{122}In	−83580	50				*	1.5	s	0.3	1^{+}	94			β^{-}=100	
^{122}In^{m}	−83540#	80#	40#	60#		*	10.3	s	0.6	5^{+}	94			β^{-}=100	
^{122}In^{n}	−83290	130	290	140	BD		10.8	s	0.4	8^{-}	94			β^{-}=100	
^{122}Sn	−89945.9	2.7					STABLE			0^{+}	94			IS=4.63 3; 2β^{-} ?	
^{122}Sb	−88330.2	2.2					2.7238	d	0.0002	2^{-}	94			β^{-}=97.59 12; . . .	*
^{122}Sb^{m}	−88166.6	2.2	163.5591	0.0017			4.191	m	0.003	$(8)^{-}$	94			IT=100	
^{122}Sb^{n}	−88192.7	2.2	137.472	0.001			530	μs		5^{+}					
^{122}Te	−90314.0	1.5					STABLE			0^{+}	94			IS=2.55 12	
^{122}I	−86080	5					3.63	m	0.06	1^{+}	94			β^{+}=100	
^{122}Xe	−85355	11					20.1	h	0.1	0^{+}	94			ε=100	
^{122}Cs	−78140	30					21.18	s	0.19	1^{+}	96	93Al03	T	β^{+}=100; $\beta^{+}\alpha$<2e–7	*
^{122}Cs^{m}	−78005	9	140	30	MD		3.70	m	0.11	8^{-}	96			β^{+}=100	
^{122}Cs^{n}	−78010	30	127.0	0.5			360	ms	20	$(5)^{-}$	96			IT=100	
^{122}Ba	−74609	28					1.95	m	0.15	0^{+}	94			β^{+}=100	
^{122}La	−64540#	300#					8.7	s	0.7		94			β^{+}=100; β^{+}p=?	
^{122}Ce	−57840#	400#					2#	s		0^{+}	94			β^{+} ?; β^{+}p ?	*
^{122}Pr	−44890#	500#					500#	ms						β^{+} ?	

*^{122}Pd I : and T>240 ns in 97So07 **
*^{122}Ag D : β^{-}n intensity is from 93Ru01 **
*^{122}Sb D : . . . ; β^{+}=2.41 12 **
*^{122}Cs T : average 93Al03=21.2(0.2) 69Ch18=21.0(0.7) **
*^{122}Cs D : $\beta^{+}\alpha$ intensity upper limit is from 75Ho09 **
*^{122}Ce I : T=8.7(0.7) s in NDS 71 (1994) was misprint for ^{122}La; corrected in ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{123}Pd	−60610#	600#				200#	ms	(>300 ns)			94Be24	I	β^- ?	
^{123}Ag	−69960#	210#				296	ms	6	(7/2$^+$)	94	95Fe12	T	β^-=100; β^-n=0.55 5	*
^{123}Cd	−77310	40				2.10	s	0.02	(3/2)$^+$	94			β^-=100	
^{123}Cd^m	−76990	40	316.52	0.23		1.82	s	0.03	(11/2$^-$)	94			β^-=?; IT=?	
^{123}In	−83426	24				5.98	s	0.06	9/2$^+$	94			β^-=100	
^{123}In^m	−83099	24	327.21	0.04		47.8	s	0.5	1/2$^-$	94			β^-=100	
^{123}Sn	−87820.5	2.7				129.2	d	0.4	11/2$^-$	94			β^-=100	
^{123}Sn^m	−87795.9	2.7	24.6	0.4		40.06	m	0.01	3/2$^+$	94			β^-=100	
^{123}Sb	−89224.1	2.1				STABLE			7/2$^+$	94			IS=42.79 5	
^{123}Te	−89171.9	1.5				> 600	Ty		1/2$^+$	94	96Al30	T	IS=0.89 3; ε=100	*
^{123}Te^m	−88924.3	1.5	247.55	0.04		119.25	d	0.15	11/2$^-$	94			IT=100	
^{123}I	−87943	4				13.2235	h	0.0019	5/2$^+$	94	02Un02	T	β^+=100	
^{123}Xe	−85249	10				2.08	h	0.02	1/2$^+$	94	90Ne.A	J	β^+=100	
^{123}Xe^m	−85064	10	185.18	0.22		5.49	μs	0.26	7/2$^{(-)}$					
^{123}Cs	−81044	12				5.87	m	0.04	1/2$^+$	94	93Al03	T	β^+=100	*
^{123}Cs^m	−80887	12	156.74	0.21		1.64	s	0.12	(11/2)$^-$	94			IT=100	
^{123}Cs^x	−81037	13	7	4		$R < 0.1$			spmix					
^{123}Ba	−75655	12				2.7	m	0.4	5/2$^+$	94			β^+=100	
^{123}La	−68710#	200#				17	s	3	11/2$^-$#	94			β^+=100	
^{123}Ce	−60180#	300#				3.8	s	0.2	(5/2)$^{(+\#)}$	94			β^+=100; β^+p=?	
^{123}Pr	−50340#	600#				800#	ms		3/2$^+$#				β^+ ?	

*^{123}Ag T : average 95Fe12=293(7) 86Ma42=300(20) 83Re05=300(10) D : from 93Ru01 **
*^{123}Te T : and T=24(9) Ey for ε(K), same authors **
*^{123}Te I : this nuclide is not considered ‘stable’ since K ε has been observed **
*^{123}Cs T : average 93Al03=5.87(0.05) 68Ch18=5.87(0.05) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{124}Pd	−58800#	500#				100#	ms	(>300 ns)	0$^+$		97Be70	I	β^- ?	
^{124}Ag	−66470#	200#			*	172	ms	5	3$^+$#	97			β^-=100; β^-n>0.1	
^{124}Ag^m	−66470#	220#	0#	100#	*	200#	ms		8$^-$#		95Kr.A	I	β^- ?; IT ?	*
^{124}Cd	−76710	60				1.25	s	0.02	0$^+$	97			β^-=100	
^{124}In	−80880	50			*	3.11	s	0.10	3$^+$	97			β^-=100	
^{124}In^m	−80900	50	−20	70	BD *	3.7	s	0.2	(8)$^{(-\#)}$	97			$\beta^-\approx$100; IT ?	
^{124}Sn	−88236.8	1.4				STABLE		(>100 Py)	0$^+$	97	52Ka41	T	IS=5.79 5; 2β^- ?	
^{124}Sn^m	−85911.8	1.4	2325.01	0.04		3.1	μs	0.5	7$^-$	97			IT=100	
^{124}Sn^n	−85580.2	1.5	2656.6	0.5		45	μs	5	10$^+$#	97			IT=100	
^{124}Sb	−87620.3	2.1				60.20	d	0.03	3$^-$	98			β^-=100	
^{124}Sb^m	−87609.4	2.1	10.8627	0.0008		93	s	5	5$^+$	97			IT=75 5; β^-=25 5	
^{124}Sb^n	−87583.5	2.1	36.8440	0.0014		20.2	m	0.2	(8)$^-$	97			IT=100	
^{124}Sb^p	−87579.5	2.1	40.8038	0.0007		3.2	μs	0.3	(3$^+$,4$^+$)	97			IT=100	
^{124}Te	−90524.5	1.5				STABLE			0$^+$	97			IS=4.74 14	
^{124}I	−87365.0	2.4				4.1760	d	0.0003	2$^-$	97			β^+=100	
^{124}Xe	−87660.1	1.8				STABLE		(>48 Py)	0$^+$	97	89Ba22	T	IS=0.09 1; 2β^+ ?	
^{124}Cs	−81731	8				30.9	s	0.4	1$^+$	97	93Al03	T	β^+=100	*
^{124}Cs^m	−81268	8	462.55	0.17		6.3	s	0.2	(7)$^+$	97			IT=100	
^{124}Cs^x	−81701	22	30	20		R =?			spmix					
^{124}Ba	−79090	12				11.0	m	0.5	0$^+$	97			β^+=100	
^{124}La	−70260	60			*	29.21	s	0.17	(7$^-$,8$^-$)	97	97As05	T	β^+=100	*
^{124}La^m	−70160#	120#	100#	100#	*	21	s	4	low$^{(+\#)}$	97	97As05	T	β^+=100	
^{124}Ce	−64820#	300#				9.1	s	1.2	0$^+$	98	97As05	T	β^+=100	*
^{124}Pr	−53130#	600#				1.2	s	0.2		97			β^+=100; β^+p=?	
^{124}Nd	−44500#	600#				500#	ms		0$^+$				β^+ ?	

*^{124}Ag^m I : “There is some evidence for a low-spin and a high-spin isomer in ^{124}Ag” **
*^{124}Cs T : average 93Al03=30.9(0.5) 78Ek05=30.8(0.5) **
*^{124}La J : for ^{124}La and ^{124}La^m are from 92Id01 **
*^{124}Ce T : average 97As05=10.8(1.5) 78Bo32=6(2) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{125}Ag	−64800#	300#				166	ms	7	$7/2^+$#	99			β^-=100; β^-n=?	
^{125}Cd	−73360	70			*	650	ms	20	$3/2^+$#	99			β^-=100	
^{125}Cd^m	−73310	50	50	70	BD *	570	ms	90	$11/2^-$#	99	89Hu03	T	β^-=100	*
^{125}In	−80480	30				2.36	s	0.04	$9/2^+$	99			β^-=100	
^{125}In^m	−80120	30	360.12	0.09		12.2	s	0.2	$1/2^{(-)}$	99			β^-=100	
^{125}Sn	−85898.5	1.5				9.64	d	0.03	$11/2^-$	99			β^-=100	
^{125}Sn^m	−85871.0	1.5	27.50	0.14		9.52	m	0.05	$3/2^+$	99			β^-=100	
^{125}Sb	−88255.5	2.6				2.75856	y	0.00025	$7/2^+$	99			β^-=100	
^{125}Te	−89022.2	1.5				STABLE			$1/2^+$	99			IS=7.07 15	
^{125}Te^m	−88877.4	1.5	144.772	0.009		57.40	d	0.15	$11/2^-$	99			IT=100	
^{125}I	−88836.4	1.5				59.400	d	0.010	$5/2^+$	99			ε=100	
^{125}Xe	−87192.1	1.9				16.9	h	0.2	$1/2^{(+)}$	99			β^+=100	
^{125}Xe^m	−86939.5	1.9	252.60	0.14		56.9	s	0.9	$9/2^{(-)}$	99			IT=100	
^{125}Cs	−84088	8				45	m	1	$1/2^{(+)}$	99			β^+=100	
^{125}Cs^m	−83821	8	266.6	1.1		900	ms	30	$(11/2^-)$	99	98Su16	TJ	IT=100	
^{125}Ba	−79668	11				3.5	m	0.4	$1/2^{(+\#)}$	99			β^+=100	
^{125}La	−73759	26				64.8	s	1.2	$(11/2^-)$	99			β^+=100	*
^{125}La^m	−73652	26	107.0	0.1		390	ms	40	$(3/2^+)$	99	99Ca21	ETJ	IT=100	*
^{125}Ce	−66660#	200#				9.3	s	0.3	$(7/2^-)$	99	02Pe15	J	β^+=100; β^+p=?	*
^{125}Pr	−57910#	400#				3.3	s	0.7	$3/2^+$#	02			β^+=100; β^+p ?	
^{125}Nd	−47620#	400#				600	ms	150	$5/2^{(+\#)}$	02			β^+=100	

*^{125}Cd^m T : unweighed average 89Hu03=480(30) 86Ma42=660(30) (Birge ratio B=4.24) **
*^{125}La J : ENSDF'99 says ground-state spin unknown; a $(11/2^-)$ level lies at 8-9 keV above ground-state **
*^{125}La^m J : $3/2^+$# from systematics; low spin and even-parity from 99Ca21 **
*^{125}Ce T : average 99Ca21=9.6(0.4) 86Wi15=9.2(1.0) 83Ni05=8.9(0.5) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{126}Ag	−61010#	300#				107	ms	12	3^+#	03			β^-=100; β^-n=?	
^{126}Cd	−72330	50				515	ms	17	0^+	03			β^-=100	
^{126}In	−77810	40			*	1.53	s	0.01	$3^{(+\#)}$	03			β^-=100	
^{126}In^m	−77710	50	100	60	BD *	1.64	s	0.05	$8^{(-\#)}$	03	79Fo10	J	β^-=100	
^{126}Sn	−86020	11				230	ky	14	0^+	03			β^-=100	
^{126}Sn^m	−83801	11	2218.99	0.08		6.6	μs	1.4	7^-	03			IT=100	
^{126}Sn^n	−83456	11	2564.5	0.5		7.7	μs	0.5	10^+#	03			IT=100	
^{126}Sb	−86400	30				12.35	d	0.06	(8^-)	03			β^-=100	
^{126}Sb^m	−86380	30	17.7	0.3		19.15	m	0.08	(5^+)	03			β^-=86 4; IT=14 4	
^{126}Sb^n	−86360	30	40.4	0.3		11	s		(3^-)	03			IT=100	
^{126}Sb^p	−86300	30	104.6	0.3		553	ns	5	(3^+)	03			IT=100	
^{126}Te	−90064.6	1.5				STABLE			0^+	03			IS=18.84 25	
^{126}I	−87911	4				12.93	d	0.05	2^-	03			β^+=52.7 5; β^-=47.3 5	
^{126}Xe	−89169	6				STABLE			0^+	03			IS=0.09 1; $2\beta^+$?	
^{126}Cs	−84345	12				1.64	m	0.02	1^+	03			β^+=100	
^{126}Cs^m	−84072	12	273.0	0.7		> 1	μs			03			IT=100	
^{126}Cs^n	−83749	12	596.1	1.1		171	μs	14		03			IT=100	
^{126}Ba	−82670	12				100	m	2	0^+	03			β^+=100	
^{126}La	−74970	90			*	54	s	2	$(5)^{(+\#)}$	03			β^+=100	
^{126}La^m	−74760	400	210	410	BD *	20	s	20	$(0^-,1^-,2^-)$	03			β^+=100	*
^{126}Ce	−70821	28				51.0	s	0.3	0^+	03			β^+=100	
^{126}Pr	−60260#	200#				3.12	s	0.18	$(4,5,6)$	03	88Ba42	T	β^+=100; β^+p=?	*
^{126}Nd	−52890#	400#				1#	s	(>200 ns)	0^+	03	00So11	I	β^+ ?	
^{126}Pm	−39570#	500#				500#	ms						β^+ ?	

*^{126}La^m T : 97As05: "by far shorter than 50 s" **
*^{126}Pr T : average 95Os03=3.14(0.22) 88Ba42=3.0(0.4) and 83Ni05=3.2(0.6) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{127}Ag	−58900#	300#					79	ms	3	$7/2^+$#	98	96Wo.A	TD	β^-=100; β^-n=?	*
^{127}Cd	−68520	70					370	ms	70	$(3/2^+)$	96			β^-=100	
^{127}In	−76990	40					1.09	s	0.01	$9/2^{(+)}$	96	87Eb02	J	β^-=100; β^-n≤0.03	
^{127}In^m	−76520	70	460	70	BD		3.67	s	0.04	$(1/2^-)$	96			β^-=100; β^-n=0.69 4	
^{127}Sn	−83499	25					2.10	h	0.04	$(11/2^-)$	96			β^-=100	
^{127}Sn^m	−83494	25	4.7	0.3			4.13	m	0.03	$(3/2^+)$	96			β^-=100	
^{127}Sb	−86700	5					3.85	d	0.05	$7/2^+$	96			β^-=100	
^{127}Te	−88281.1	1.5					9.35	h	0.07	$3/2^+$	96			β^-=100	
^{127}Te^m	−88192.8	1.5	88.26	0.08			109	d	2	$11/2^-$	96			IT=97.6 2; β^-=2.4 2	
^{127}I	−88983	4					STABLE			$5/2^+$	96			IS=100.	
^{127}Xe	−88321	4					36.345	d	0.003	$1/2^+$	96	02Un02	T	ε=100	
^{127}Xe^m	−88024	4	297.10	0.08			69.2	s	0.9	$9/2^-$	96			IT=100	
^{127}Cs	−86240	6					6.25	h	0.10	$1/2^+$	96			β^+=100	
^{127}Cs^m	−85788	6	452.23	0.21			55	μs	3	$(11/2)^-$	96			IT=100	
^{127}Ba	−82816	11					12.7	m	0.4	$1/2^+$	96			β^+=100	
^{127}Ba^m	−82736	11	80.33	0.12			1.9	s	0.2	$7/2^-$	96			IT=100	
^{127}La	−77896	26					5.1	m	0.1	$(11/2^-)$	96			β^+=100	
^{127}La^m	−77881	26	14.8	1.2			3.7	m	0.4	$(3/2^+)$	96			β^+≈100; IT ?	
^{127}Ce	−71980	60				*	29	s	2	$5/2^+$#	98	96Ge07	T	β^+=100	
^{127}Ce^m	−71980#	120#	0#	100#		*	34	s	2	$(1/2^+)$		96Ge07	TJD	β^+=100	
^{127}Pr	−64430#	200#					4.2	s	0.3	$3/2^+$#	98			β^+=100	
^{127}Pr^m	−63830#	280#	600#	200#			50#	ms		$11/2^-$		98Mo30	J	β^+ ?; IT ?	
^{127}Nd	−55420#	400#					1.8	s	0.4	$5/2^+$#	96			β^+=100; β^+p=?	
^{127}Pm	−45060#	600#					1#	s		$5/2^+$#				β^+ ?; p ?	

*^{127}Ag T : supersedes 95Fe12=109(25) from same group **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{128}Ag	−54800#	300#					58	ms	5		01			β^-=100; β^-n=?	
^{128}Cd	−67290	290					280	ms	40	0^+	01			β^-=100	
^{128}In	−74360	50					840	ms	60	$(3)^+$	01	93Ru01	D	β^-=100; β^-n=0.038 3	
^{128}In^m	−74110	50	247.87	0.10			10	ms	7	$(1)^-$	01			IT=100	*
^{128}In^n	−74040	50	320	60	BD		720	ms	100	(8^-)	01			β^-=100	
^{128}Sn	−83335	27					59.07	m	0.14	0^+	01			β^-=100	
^{128}Sn^m	−81244	27	2091.50	0.11			6.5	s	0.5	(7^-)	01			IT=100	
^{128}Sb	−84609	25				*	9.01	h	0.04	8^-	01			β^-=100	
^{128}Sb^m	−84599	24	10	7		*	10.4	m	0.2	5^+	01			β^-=96.4 10; IT=3.6 10	*
^{128}Te	−88992.1	1.7					2.2	Yy	0.3	0^+	01	96Ta04	T	IS=31.74 8; $2\beta^-$=100	*
^{128}Te^m	−86201.4	1.7	2790.7	0.4			370	ns	30	10^+	01			IT=100	
^{128}I	−87738	4					24.99	m	0.02	1^+	01			β^-=93.1 8; β^+=6.9 8	
^{128}I^m	−87600	4	137.850	0.004			845	ns	20	4^-	01			IT=100	
^{128}I^n	−87571	4	167.367	0.005			175	ns	15	$(6)^-$	01			IT=100	
^{128}Xe	−89860.0	1.4					STABLE			0^+	01			IS=1.92 3	
^{128}Xe^m	−87072.7	1.5	2787.3	0.4			83	ns	2	8^-	01			IT=100	
^{128}Cs	−85931	5					3.640	m	0.014	1^+	01	93Al03	T	β^+=100	*
^{128}Ba	−85402	10					2.43	d	0.05	0^+	01			ε=100	
^{128}La	−78630	50				*	5.18	m	0.14	(5^+)	01			β^+=100	
^{128}La^m	−78530#	110#	100#	100#		*	< 1.4	m		$(1^+,2^-)$	01			β^+=100	
^{128}Ce	−75534	28					3.93	m	0.02	0^+	01			β^+=100	
^{128}Pr	−66331	30					2.84	s	0.09	(3^+)	01	99Xi03	J	β^+=100; β^+p=?	*
^{128}Nd	−60180#	200#					5#	s		0^+	01			β^+ ?; β^+p ?	*
^{128}Pm	−48050#	400#					1.0	s	0.3	6^+#	01	93Li40	D	β^+≈100; β^+p ?; p=0	*
^{128}Sm	−39050#	500#					500#	ms		0^+				β^+ ?; p ?	

*^{128}In^m T : 10 μs < half-life < 20 ms, cf. ENSDF **
*^{128}Sb^m E : less than 20 keV above ground state, cf. ENSDF **
*^{128}Te T : see also 92Be30=7.7(0.4) not used for consistency with ^{130}Te (see below) **
*^{128}Cs T : average 93Al03=3.66(0.02) 76He04=3.62(0.02) **
*^{128}Pr D : from 85Wi07 **
*^{128}Nd T : 83Ni05 gave 4(2) s. Proved, by 85Wi07, to be due to ^{128}Pr, not to ^{128}Nd **
*^{128}Pm D : p=0 from 93Li40 J : as calculated by 02Xu11 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{129}Ag	−52450#	400#				∗	44	ms	7	$7/2^+$#	03			β^-=100; β^-n=?	
^{129}Ag^m	−52450#	450#	0#	200#	EU	∗	160	ms		$1/2^-$#	03			β^- ?; β^-n ?	∗
^{129}Cd	−63200#	300#				∗	242	ms	8	$3/2^+$#	96	03Pf.A	TD	β^-=100; β^-n=?	
^{129}Cd^m	−63200#	360#	0#	200#		∗	104	ms	6	$11/2^-$#		03Pf.A	TD	β^-=100; β^-n=?	
^{129}In	−72940	40					611	ms	4	$9/2^+$#	96	93Ru01	T	β^-=100; β^-n=0.25 5	∗
^{129}In^m	−72560	70	380	70	BD		1.23	s	0.03	$1/2^-$#	96			$\beta^-\approx$100; IT<0.3; . . .	∗
^{129}In^n	−71250	40	1688.0	0.5			8.5	μs	0.5	$17/2^-$		03Ge04	ETJ	IT=100	
^{129}Sn	−80594	29					2.23	m	0.04	$3/2^+$#	96			β^-=100	
^{129}Sn^m	−80559	29	35.2	0.3			6.9	m	0.1	$11/2^-$#	96			$\beta^-\approx$100; IT$\approx$0.002	
^{129}Sb	−84628	21					4.40	h	0.01	$7/2^+$	96			β^-=100	
^{129}Sb^m	−82777	21	1851.05	0.10			17.7	m	0.1	$(19/2^-)$	96			β^-=85; IT=15	
^{129}Sb^n	−82767	21	1860.90	0.10			>2	μs		$(15/2^-)$	96			IT=100	
^{129}Sb^p	−82489	21	2138.9	0.5			1.1	μs	0.1	$(23/2^+)$		03Ge04	ETJ	IT=100	
^{129}Te	−87003.2	1.8					69.6	m	0.3	$3/2^+$	96			β^-=100	
^{129}Te^m	−86897.7	1.8	105.50	0.05			33.6	d	0.1	$11/2^-$	96			IT=63 17; β^-=37 17	
^{129}I	−88503	3					15.7	My	0.4	$7/2^+$	96			β^-=100	
^{129}Xe	−88697.4	0.7					STABLE			$1/2^+$	96			IS=26.44 24	
^{129}Xe^m	−88461.3	0.7	236.14	0.05			8.88	d	0.02	$11/2^-$	96			IT=100	
^{129}Cs	−87500	5					32.06	h	0.06	$1/2^+$	96			β^+=100	
^{129}Ba	−85065	11					2.23	h	0.11	$1/2^+$	96			β^+=100	
^{129}Ba^m	−85057	11	8.42	0.06			2.16	h	0.02	$7/2^+$#	96			$\beta^+\approx$100; IT=?	
^{129}La	−81326	21					11.6	m	0.2	$3/2^+$	96			β^+=100	
^{129}La^m	−81154	21	172.1	0.4			560	ms	50	$11/2^-$	96			IT=100	
^{129}Ce	−76287	28					3.5	m	0.3	$(5/2^+)$	97	93Al03	T	β^+=100	∗
^{129}Ce^m	−76179	28	107.6	0.1			62	ns	5	$(7/2^-)$	96			IT=100	
^{129}Pr	−69774	30				&	30	s	4	$(3/2^+)$	96	96Gi08	J	β^+=100	
^{129}Pr^m	−69390	30	382.7	0.5		&	1#	ms		$(11/2^-)$		97Gi07	EJD	IT=100	
^{129}Nd	−62240#	200#					4.9	s	0.2	$5/2^+$#	96			β^+=100; β^+p=?	
^{129}Pm	−52950#	400#					3#	s	(>200 ns)	$5/2^+$#		00So11	I	β^+ ?	
^{129}Sm	−42250#	500#					550	ms	100	$5/2^+$#		99Xu05	TD	β^+=100	

∗^{129}Ag I : the evaluators are not convinced by the identification arguments ∗∗
∗^{129}In T : average 93Ru01=611(5) 86Wa17=610(10) ∗∗
∗^{129}In^m D : . . . ; β^-n=2.5 5 ∗∗
∗^{129}Ce J : from 96Gi08 (5/2$^+$ in ENSDF was from theory) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{130}Ag	−46160#	330#					50	ms		0^+	01			β^-=100; β^-n ?	
^{130}Cd	−61570	280					162	ms	7	0^+	01	01Ha39	TD	β^-=100; β^-n=3.5 10	
^{130}In	−69890	40				∗	290	ms	20	(1^-)	01			β^-=100; β^-n=0.93 13	
^{130}In^m	−69840	40	50	50	BD	∗	538	ms	5	10^-#	01	93Ru01	T	β^-=100; β^-n=1.65 15	∗
^{130}In^n	−69490	50	400	60	BD		540	ms	10	(5^+)	01			β^-=100; β^-n=1.65 15	
^{130}Sn	−80139	11					3.72	m	0.07	0^+	01			β^-=100	
^{130}Sn^m	−78192	11	1946.88	0.10			1.7	m	0.1	7^-#	01			β^-=100	
^{130}Sb	−82292	17					39.5	m	0.8	8^-#	01			β^-=100	
^{130}Sb^m	−82287	17	4.80	0.20			6.3	m	0.2	$(4,5)^+$	01			β^-=100	
^{130}Te	−87351.4	1.9					790	Ey	100	0^+	01	96Ta04	TD	IS=34.08 62; 2β^-=100	∗
^{130}Te^m	−85205.0	1.9	2146.41	0.04			115	ns	8	$(7)^-$	01			IT=100	
^{130}Te^n	−84690	7	2661	7			1.90	μs	0.08	(10^+)	01			IT=100	∗
^{130}Te^p	−82976.0	2.6	4375.4	1.8			261	ns	33		01			IT=100	
^{130}I	−86932	3					12.36	h	0.01	5^+	01			β^-=100	
^{130}I^m	−86892	3	39.9525	0.0013			8.84	m	0.06	2^+	01			IT=84 2; β^-=16 2	
^{130}Xe	−89881.7	0.7					STABLE			0^+	01			IS=4.08 2	
^{130}Cs	−86900	8					29.21	m	0.04	1^+	01			β^+=98.4; β^-=1.6	
^{130}Cs^m	−86737	8	163.25	0.11			3.46	m	0.06	5^-	01			IT$\approx$100; β^+=0.16 2	
^{130}Cs^x	−86873	17	27	15			$R=.2$	.1		fsmix					
^{130}Ba	−87261.6	2.8					STABLE		(>4.0 Zy)	0^+	01	96Ba24	T	IS=0.106 1; 2β^+ ?	
^{130}Ba^m	−84786.5	2.8	2475.12	0.18			9.54	ms	0.14	8^-	01	02Mo31	T	IT=100	∗

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
... *A*-group continued ...														
^{130}La	−81628	26				8.7	m	0.1	$3^{(+)}$	01			β^+=100	
^{130}Ce	−79423	28				22.9	m	0.5	0^+	01			β^+=100	
^{130}Ce^m	−76969	28	2453.6	0.3		100	ns	8	(7^-)	01			IT=100	
^{130}Pr	−71180	60				40.0	s	0.4	$(6,7)^{(+\#)}$	01	88Ba42	J	β^+=100	
^{130}Pr^m	−71080#	120#	100#	100#		10#	s		2^+#	01	88Ba42	J	β^+ ?	*
^{130}Nd	−66596	28				21	s	3	0^+	01	01Gi17	T	β^+=100	*
^{130}Pm	−55470#	300#				2.6	s	0.2	$(5^+,6^+,4^+)$	01	99Xi03	J	β^+=100; β^+p=?	
^{130}Sm	−47580#	400#				1#	s		0^+	01			β^+ ?	
^{130}Eu	−33940#	500#				1.1	ms	0.5	2^+#		02Ma61	TD	p=?; β^+=1#	
*^{130}In^m	T : average 93Ru01=542(9) 85Re.A=532(6) and 86Wa17=550(10)													**
*^{130}In^m	T : 76Lu02=580(10) at variance, not used													**
*^{130}Te	T : see also numerous (not used) results in 95Tr07													**
*^{130}Te	T : treated by ENSDF'01 as a lower limit (not accepted by NUBASE)													**
*^{130}Te^n	E : less than 25 keV above 2648.57(0.22) (8^+) level, see ENSDF'01													**
*^{130}Ba^m	T : others 66Br14=8.8(0.2) 69Wa.A=13.5(1.0) not used													**
*^{130}Pr^m	J : 88Ba42: there is also a low-spin component in ^{130}Pr activity													**
*^{130}Pr^m	J : see also the discussion in 01Gi17 on three isomeric states in ^{130}Pr													**
*^{130}Nd	T : other conflicting data, not used: 00Xu08=13(3) 77Bo02=28(3)													**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{131}Cd	−55270#	300#				68	ms	3	$7/2^-$#		00Ha55	TD	β^-=100; β^-n=3.5 10	
^{131}In	−68137	28				280	ms	30	$(9/2^+)$	94	93Ru01	D	β^-=100; β^-n=2.2 3	
^{131}In^m	−67790	40	350	40	BD	350	ms	50	$(1/2^-)$	94			$\beta^-\approx$100; ...	*
^{131}In^n	−64040	70	4100	70	BD	320	ms	60	$(19..23/2^+)$	94			β^->99; ...	*
^{131}Sn	−77314	21				56.0	s	0.5	$(3/2^+)$	94			β^-=100	
^{131}Sn^m	−77230#	40#	80#	30#		58.4	s	0.5	$(11/2^-)$	94	01Si.A	E	β^-=100; IT<0.0004#	*
^{131}Sb	−81988	21				23.03	m	0.04	$(7/2^+)$	94			β^-=100	
^{131}Te	−85209.5	1.9				25.0	m	0.1	$3/2^+$	94			β^-=100	
^{131}Te^m	−85027.3	1.9	182.250	0.020		30	h	2	$11/2^-$	94			β^-=77.8 16;IT=22.2 16	
^{131}I	−87444.4	1.1				8.02070	d	0.00011	$7/2^+$	94			β^-=100	
^{131}Xe	−88415.2	1.0				STABLE			$3/2^+$	94			IS=21.18 3	
^{131}Xe^m	−88251.3	1.0	163.930	0.008		11.84	d	0.07	$11/2^-$	94			IT=100	
^{131}Cs	−88060	5				9.689	d	0.016	$5/2^+$	94			ε=100	
^{131}Ba	−86683.8	2.8				11.50	d	0.06	$1/2^+$	94			β^+=100	
^{131}Ba^m	−86496.7	2.8	187.14	0.12		14.6	m	0.2	$9/2^-$	94			IT=100	
^{131}La	−83769	28				59	m	2	$3/2^+$	94			β^+=100	
^{131}La^m	−83464	28	304.52	0.24		170	μs	10	$11/2^-$	94			IT=100	
^{131}Ce	−79720	30				10.2	m	0.3	$(7/2^+)$	99			β^+=100	
^{131}Ce^m	−79660	30	61.8	0.1		5.0	m	1.0	$(1/2^+)$	99	96Gi08	E	β^+=100	
^{131}Ce^n	−79560	30	162.00	0.09		70	ns	5	$(9/2^-)$					
^{131}Pr	−74280	50				1.50	m	0.03	$(3/2^+)$	94	96Gi08	T	β^+=100	*
^{131}Pr^m	−74130	50	152.4	0.2		5.7	s	0.2	$(11/2^-)$	94	96Ge12	ED	IT=96.4 12; β^+=3.6 12	
^{131}Nd	−67769	28				33	s	3	$(5/2)^{(+\#)}$	94	96Ge12	T	β^+=100; β^+p=?	
^{131}Nd^m	−67412	28	357	3		50	ns		$(7/2^-)$	94	96Ge12	J	IT=100	
^{131}Pm	−59740#	200#				6.3	s	0.8	$5/2^+$#	94	99Ga41	T	β^+=100; β^+p ?	
^{131}Sm	−50200#	300#				1.2	s	0.2	$5/2^+$#	94			β^+=100; β^+p=?	
^{131}Eu	−39350#	400#				17.8	ms	1.9	$3/2^+$	02			p=?; β^+=12#	
*^{131}In^m	D : ... ; β^-n≤2.0 4; IT≤0.018													**
*^{131}In^n	D : ... ; β^-n=0.028 5; IT<1													**
*^{131}Sn^m	E : ENSDF'94=241.8(0.8) questioned from theoretical and exp. considerations													**
*^{131}Pr	T : average 96Gi08=1.57(0.07) 93Al03=1.48(0.02) and 83Ga.A=1.58(0.05)													**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{132}Cd	−50720#	500#				97	ms	10	0^+		00Ha55	TD	β^-=100; β^-n=60 15	
^{132}In	−62420	60				206	ms	4	(7^-)	02			β^-=100; β^-n=6.2 11	
^{132}Sn	−76554	14				39.7	s	0.5	0^+	92			β^-=100	
^{132}Sb	−79674	14				2.79	m	0.05	(4^+)	92			β^-=100	
^{132}Sb^m	−79470	30	200	30		4.15	m	0.05	(8^-)	92	89St06	E	β^-=100	
^{132}Te	−85182	7				3.204	d	0.013	0^+	92			β^-=100	
^{132}I	−85700	6				2.295	h	0.013	4^+	92			β^-=100	
^{132}I^m	−85595	10	104	12	BD	1.387	h	0.015	(8^-)	92			IT=86 2; β^-=14 2	
^{132}Xe	−89280.5	1.0				STABLE			0^+	92			IS=26.89 6	
^{132}Xe^m	−86528.2	1.0	2752.27	0.17		8.39	ms	0.11	(10^+)	92			IT=100	
^{132}Cs	−87155.9	1.9				6.479	d	0.007	2^+	92			β^+=98.13 9; β^-=1.87 9	
^{132}Ba	−88434.8	1.1				STABLE		(>300 Ey)	0^+	94	96Ba24	T	IS=0.101 1; 2β^+ ?	
^{132}La	−83740	40				4.8	h	0.2	2^-	94			β^+=100	
^{132}La^m	−83550	40	188.18	0.11		24.3	m	0.5	6^-	94			IT=76; β^+=24	
^{132}Ce	−82474	21				3.51	h	0.11	0^+	99			β^+=100	
^{132}Ce^m	−80133	21	2340.8	0.5		9.4	ms	0.3	(8^-)	99	01Mo05	TJ	IT=100	
^{132}Pr	−75210	60			*	1.49	m	0.11	(2^+)	01	94Bu18	TJ	β^+=100	*
^{132}Pr^m	−75210#	120#	0#	100#	*	20#	s		(5^+)		90Ko25	J	β^+ ?	
^{132}Nd	−71426	24				1.56	m	0.10	0^+	97	95Bu11	T	β^+=100	*
^{132}Pm	−61710#	200#				6.3	s	0.7	(3^+)	92			β^+=100; β^+p≈5e–5	
^{132}Sm	−55250#	300#				4.0	s	0.3	0^+	92			β^+=100; β^+p ?	
^{132}Eu	−42500#	400#				100#	ms				93Li40	D	β^+ ?; p=0	

*^{132}Pr T : average 94Bu18=1.47(0.12) 74Ar27=1.6(0.3) **
*^{132}Nd T : average 95Bu11=1.47(0.12) 77Bo02=1.75(0.17) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{133}In	−57930#	300#				165	ms	3	$(9/2^+)$	02	96Ho16	J	β^-=100; β^-n=85 10	*
^{133}In^m	−57600#	300#	330#	40#		180#	ms		$(1/2^-)$		96Ho16	J	IT ?	
^{133}Sn	−70950	40				1.45	s	0.03	$7/2^-$#	98	93Ru01	D	β^-=100; β^-n=0.0294 24	
^{133}Sb	−78943	25				2.5	m	0.1	$(7/2^+)$	95			β^-=100	
^{133}Te	−82945	24				12.5	m	0.3	$(3/2^+)$	95			β^-=100	
^{133}Te^m	−82611	24	334.26	0.04		55.4	m	0.4	$(11/2^-)$	95			β^-=82.5 30; IT=17.5 30	
^{133}I	−85887	5				20.8	h	0.1	$7/2^+$	95			β^-=100	
^{133}I^m	−84253	5	1634.174	0.017		9	s	2	$(19/2^-)$	95			IT=100	
^{133}Xe	−87643.6	2.4				5.2475	d	0.0005	$3/2^+$	95	02Un02	T	β^-=100	
^{133}Xe^m	−87410.4	2.4	233.221	0.018		2.19	d	0.01	$11/2^-$	95			IT=100	
^{133}Cs	−88070.958	0.022				STABLE			$7/2^+$	95			IS=100.	
^{133}Ba	−87553.5	1.0				10.51	y	0.05	$1/2^+$	95			ε=100	
^{133}Ba^m	−87265.3	1.0	288.247	0.009		38.9	h	0.1	$11/2^-$	95			IT≈100; ε=0.0096 11	
^{133}La	−85494	28				3.912	h	0.008	$5/2^+$	95			β^+=100	
^{133}La^m	−84958	28	535.60	0.02		62	ns	3	$11/2^-$					
^{133}Ce	−82423	16				97	m	4	$1/2^+$	97			β^+=100	
^{133}Ce^m	−82386	16	37.1	0.8		4.9	h	0.4	$9/2^-$	97			β^+=100	
^{133}Pr	−77938	12				6.5	m	0.3	$(3/2^+)$	97			β^+=100	
^{133}Pr^m	−77746	12	192.05	0.14		1.1	μs	0.2	$(11/2^-)$	97	01Xu04	T	IT=100	
^{133}Nd	−72330	50				70	s	10	$(7/2^+)$	97			β^+=100	
^{133}Nd^m	−72200	50	127.97	0.11		70	s		$(1/2)^+$	97	95Br24	D	β^+≈100; IT=?	
^{133}Nd^n	−72150	50	176.10	0.10		300	ns		$(9/2^-)$	97			IT=100	
^{133}Pm	−65410	50			&	15	s	3	$(3/2^+)$	95	96Ga17	J	β^+=100	
^{133}Pm^m	−65280	50	130.4	1.0	&	10#	s		$(11/2^-)$		96Ga17	EJ	β^+ ?; IT ?	*
^{133}Sm	−57130#	200#				2.90	s	0.17	$(5/2^+)$	01	01Xu04	T	β^+=100; β^+p=?	*
^{133}Eu	−47280#	300#				200#	ms		$11/2^-$#				β^+ ?	

*^{133}In D : β^-n intensity is from 93Ru01 **
*^{133}Pm^m E : combining γs from Table 1: 214.7 + 357.7 + 453.8 – 252.8 – 643(1) **
*^{133}Sm T : average 01Xu04=3.1(0.5) 85Wi07=2.8(0.2) 77Bo02=3.2(0.4) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
^{134}In	−52020#	400#				140	ms	4	high	02	96Ho16 J	β^-=100; β^-n=65; ...	*
^{134}Sn	−66800	100				1.12	s	0.08	0^+	94		β^-=100; β^-n=17 13	
^{134}Sb	−74170	40			*	780	ms	60	(0^-)	95		β^-=100	
^{134}Sb^m	−74090	100	80	110	BD*	10.22	s	0.09	(7^-)	95		β^-=100; β^-n=0.091 8	
^{134}Te	−82559	11				41.8	m	0.8	0^+	98		β^-=100	
^{134}Te^m	−80868	11	1691.24	0.17		164	ns	1	6^+	98		IT=100	
^{134}I	−84072	8				52.5	m	0.2	$(4)^+$	94		β^-=100	
^{134}I^m	−83756	8	316.49	0.22		3.60	m	0.10	$(8)^-$	94		IT=97.7 10; β^-=2.3 10	
^{134}Xe	−88124.5	0.8				STABLE		(>11 Py)	0^+	94	89Ba22 T	IS=10.44 10; 2β^- ?	
^{134}Xe^m	−86159.0	0.9	1965.5	0.5		290	ms	17	7^-	94		IT=100	
^{134}Cs	−86891.181	0.026				2.0648	y	0.0010	4^+	94		β^-=100; ε=0.0003 1	
^{134}Cs^m	−86752.437	0.026	138.7441	0.0026		2.903	h	0.008	8^-	94		IT=100	
^{134}Ba	−88949.9	0.4				STABLE			0^+	95		IS=2.417 18	
^{134}La	−85219	20				6.45	m	0.16	1^+	94		β^+=100	
^{134}Ce	−84836	20				3.16	d	0.04	0^+	94		ε=100	
^{134}Pr	−78510	40			&	11	m		(5^-)	94		β^+=100	
^{134}Pr^m	−78510#	110#	0#	100#	&	17	m	2	2^-	94		β^+=100	
^{134}Nd	−75646	12				8.5	m	1.5	0^+	99		β^+=100	
^{134}Nd^m	−73353	12	2293.1	0.4		410	μs	30	$(8)^-$	99		IT=100	
^{134}Pm	−66740	60			*	22	s	1	(5^+)	94		β^+=100	
^{134}Pm^m	−66740#	120#	0#	100#	*	5	s		(2^+)	94		β^+=100	
^{134}Sm	−61510#	200#				10	s	1	0^+	94		β^+=100	
^{134}Eu	−49830#	200#				500	ms	200		94		β^+=100; β^+p=?	
^{134}Gd	−41570#	400#				400#	ms		0^+			β^+ ?	

*^{134}In D : ... ; β^-2n<4 **
*^{134}In D : β^-2n intensity limits is from 95Jo.A **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
^{135}In	−47200#	500#				92	ms	10	$9/2^+$#	02		β^- ?; β^-n ?	
^{135}Sn	−60800#	400#				530	ms	20	$(7/2^-)$	02		β^-=100; β^-n=21 3	
^{135}Sb	−69710	100				1.68	s	0.02	$(7/2^+)$	02	02Sh08 J	β^-=100; β^-n=22 3	
^{135}Te	−77830	90				19.0	s	0.2	$(7/2^-)$	98		β^-=100	
^{135}Te^m	−76280	90	1554.88	0.17		510	ns	20	$(19/2^-)$	98		IT=100	
^{135}I	−83790	7				6.57	h	0.02	$7/2^+$	98		β^-=100	
^{135}Xe	−86417	5				9.14	h	0.02	$3/2^+$	98		β^-=100	
^{135}Xe^m	−85890	5	526.551	0.013		15.29	m	0.05	$11/2^-$	98		IT≈100; β^-=0.30 17	*
^{135}Cs	−87581.9	1.0				2.3	My	0.3	$7/2^+$	98		β^-=100	
^{135}Cs^m	−85949.0	1.8	1632.9	1.5		53	m	2	$19/2^-$	98		IT=100	
^{135}Ba	−87850.5	0.4				STABLE			$3/2^+$	98		IS=6.592 12	
^{135}Ba^m	−87582.3	0.4	268.22	0.02		28.7	h	0.2	$11/2^-$	98		IT=100	
^{135}La	−86651	10				19.5	h	0.2	$5/2^+$	98		β^+=100	
^{135}Ce	−84625	11				17.7	h	0.3	$1/2^{(+)}$	98		β^+=100	
^{135}Ce^m	−84179	11	445.8	0.2		20	s	1	$(11/2^-)$	98		IT=100	
^{135}Pr	−80936	12				24	m	2	$3/2^{(+)}$	98		β^+=100	
^{135}Pr^m	−80578	12	358.06	0.06		105	μs	10	$(11/2^-)$	98		IT=100	
^{135}Nd	−76214	19				12.4	m	0.6	$9/2^{(-)}$	98		β^+=100	
^{135}Nd^m	−76149	19	65.0	0.2		5.5	m	0.5	$(1/2^+)$	98		β^+>99.97; IT<0.03	
^{135}Pm	−69980	60			*&	49	s	3	$(5/2^+,3/2^+)$	98		β^+=100	
^{135}Pm^m	−69930#	120#	50#	100#	*&	40	s	3	$(11/2^-)$	98	89Ko07 TJ	β^+=100	
^{135}Sm	−62860	150			*	10.3	s	0.5	$(7/2^+)$	98	77Bo02 J	β^+=100; β^+p=0.02 1	
^{135}Sm^m	−62860#	340#	0#	300#	*	2.4	s	0.9	$(3/2^+,5/2^+)$	98	89Vi04 TJD	β^+=100	*
^{135}Eu	−54190#	300#				1.5	s	0.2	$11/2^-$#	98		β^+=100; β^+p ?	
^{135}Gd	−44180#	500#				1.1	s	0.2	$3/2^-$	98	98St28 J	β^+=100; β^+p≈2	

*^{135}Xe^m D : β^- ranging 0.004 to 0.6% **
*^{135}Sm^m I : existence of ^{135}Sm^m and spins of both states are discussed in ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{136}Sn	−56500#	500#					250	ms	30	0^+	02			β^-=100; β^-n=30 5	
^{136}Sb	−64880#	300#					923	ms	14	1^-#	02			β^-=100; β^-n=16.3 32;...	*
^{136}Sb^m	−64710#	300#	173	3			570	ns	50	6^-#	02	01Mi22	E	IT=100	
^{136}Te	−74430	50					17.63	s	0.08	0^+	02			β^-=100; β^-n=1.31 5	
^{136}I	−79500	50					83.4	s	1.0	(1^-)	02			β^-=100	
^{136}I^m	−78850	110	650	120	BD		46.9	s	1.0	(6^-)	02			β^-=100; IT=0	
^{136}Xe	−86425	7					STABLE		(>10 Zy)	0^+	02	02Be74	T	IS=8.87 16; 2β^- ?	
^{136}Xe^m	−84533	7	1891.703	0.014			2.95	μs	0.09	6^+	02			IT=100	
^{136}Cs	−86338.7	1.9				*	13.16	d	0.03	5^+	02			β^-=100	
^{136}Cs^m	−85821	5	518	5		*	19	s	2	8^-	02	83We07	E	IT=?; β^- ?	
^{136}Ba	−88886.9	0.4					STABLE			0^+	02			IS=7.854 24	
^{136}Ba^m	−86856.4	0.4	2030.466	0.018			308.4	ms	1.9	7^-	02			IT=100	
^{136}La	−86040	50					9.87	m	0.03	1^+	02			β^+=100	
^{136}La^m	−85790	50	255	9			114	ms	3	$(8)^{(-\#)}$	02	ABBW	E	IT=100	*
^{136}Ce	−86468	13					STABLE		(>38 Py)	0^+	02	01Da22	T	IS=0.185 2; 2β^+ ?	
^{136}Ce^m	−83373	13	3095.5	0.4			2.2	μs	0.2	10^+	02			IT=100	
^{136}Pr	−81327	12					13.1	m	0.1	2^+	02			β^+=100	
^{136}Pr^m	−80732	12	594.62	0.22			91.7	ns	0.9	$(6)^+$	02			IT=100	
^{136}Nd	−79199	12					50.7	m	0.3	0^+	02			β^+=100	
^{136}Pm	−71200	80				* &	107	s	6	(5^-)	02			β^+=100	
^{136}Pm^m	−71070	90	130	120	BD	* &	47	s	2	(2^+)	02			β^+=100	
^{136}Sm	−66811	12					47	s	2	0^+	02			β^+=100	
^{136}Sm^m	−64546	12	2264.7	1.1			15	μs	1	(8^-)	02			IT=100	
^{136}Eu	−56260#	200#				*	3.3	s	0.3	(7^+)	02	89Vi04	D	β^+=100; β^+p=0.09 3	
^{136}Eu^m	−56260#	540#	0#	500#		*	3.8	s	0.3	(3^+)	02	89Vi04	D	β^+=100; β^+p=0.09 3	
^{136}Gd	−49050#	400#					1#	s	(>200 ns)	0^+	02	00So11	I	β^+ ?	
^{136}Tb	−35970#	600#					200#	ms			02			β^+ ?	

*^{136}Sb D : . . . ; β^-2n=0.28# **
*^{136}La^m E : approx. 10-40 keV above 230.1 level, from ENSDF'02, thus 230.1 + 25(9) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{137}Sn	−50310#	600#					190	ms	60	$5/2^-$#	02			β^-=100; β^-n=58 15	
^{137}Sb	−60260#	400#					450	ms	50	$7/2^+$#	94	02Sh08	TD	β^-=100; β^-n=49 10	
^{137}Te	−69560	120					2.49	s	0.05	$3/2^-$#	94	93Ru01	D	β^-=100; β^-n=2.99 16	
^{137}I	−76503	28					24.13	s	0.12	$(7/2^+)$	94	93Ru01	TD	β^-=100; β^-n=7.14 23	*
^{137}Xe	−82379	7					3.818	m	0.013	$7/2^-$	94			β^-=100	
^{137}Cs	−86545.6	0.5					30.1671	y	0.0013	$7/2^+$	01	02Un02	T	β^-=100	
^{137}Ba	−87721.2	0.4					STABLE			$3/2^+$	97			IS=11.232 24	
^{137}Ba^m	−87059.5	0.4	661.659	0.003			2.552	m	0.001	$11/2^-$	97			IT=100	
^{137}La	−87101	13					60	ky	20	$7/2^+$	94			ε=100	
^{137}Ce	−85879	13					9.0	h	0.3	$3/2^+$	94			β^+=100	
^{137}Ce^m	−85625	13	254.29	0.05			34.4	h	0.3	$11/2^-$	94			IT=99.22 3; β^+=0.78 3	
^{137}Pr	−83177	12					1.28	h	0.03	$5/2^+$	94			β^+=100	
^{137}Pr^m	−82616	12	561.22	0.23			2.66	μs		$11/2^-$					
^{137}Nd	−79580	11					38.5	m	1.5	$1/2^+$	01			β^+=100	
^{137}Nd^m	−79061	11	519.43	0.17			1.60	s	0.15	$(11/2^-)$	01			IT=100	
^{137}Pm	−74073	13				&	2#	m		$5/2^+$#				β^+ ?	
^{137}Pm^m	−73920	50	150	50	BD	&	2.4	m	0.1	$11/2^-$	94			β^+=100	
^{137}Sm	−68030	40					45	s	1	$(9/2^-)$	94			β^+=100	
^{137}Sm^m	−67850#	60#	180#	50#			20#	s		$1/2^+$#				β^+ ?	
^{137}Eu	−60020#	200#					8.4	s	0.5	$11/2^-$#	94	88Be.A	T	β^+=100	
^{137}Gd	−51210#	400#					2.2	s	0.2	$7/2^+$#	94	99Xu05	T	β^+=100; β^+p=?	
^{137}Tb	−41000#	600#					600#	ms		$11/2^-$#	96			p ?; β^+ ?	

*^{137}I T : supersedes 74Ru08=24.5(0.2) from same group **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{138}Sb	−55150#	300#					500#	ms	(>300 ns)	2^-#	03	94Be24	I	β^- ?; β^-n ?	
^{138}Te	−65930#	210#					1.4	s	0.4	0^+	03			β^-=100; β^-n=6.3 21	
^{138}I	−72330	80					6.23	s	0.03	(2^-)	03	93Ru01	D	β^-=100; β^-n=5.46 18	
^{138}Xe	−80150	40					14.08	m	0.08	0^+	03			β^-=100	
^{138}Cs	−82887	9					33.41	m	0.18	3^-	03			β^-=100	
^{138}Cs^m	−82807	9	79.9	0.3			2.91	m	0.08	6^-	03			IT=81 2; β^-=19 2	
^{138}Cs^x	−82847	25	40	23			R =?			fsmix					
^{138}Ba	−88261.6	0.4					STABLE			0^+	03			IS=71.698 42	
^{138}Ba^m	−86171.1	0.4	2090.54	0.06			800	ns	100	6^+	03			IT=100	
^{138}La	−86525	4					102	Gy	1	5^+	03			IS=0.090 1; . . .	*
^{138}La^m	−86452	4	72.57	0.03			116	ns	5	$(3)^+$	03			IT=100	
^{138}Ce	−87569	10					STABLE		(>150 Ty)	0^+	03	01Da22	T	IS=0.251 2; 2β^+ ?	
^{138}Ce^m	−85440	10	2129.17	0.12			8.65	ms	0.20	7^-	03			IT=100	
^{138}Pr	−83132	14					1.45	m	0.05	1^+	03			β^+=100	
^{138}Pr^m	−82783	17	348	23	BD		2.12	h	0.04	7^-	03			β^+=100	
^{138}Nd	−82018	12					5.04	h	0.09	0^+	03			β^+=100	
^{138}Nd^m	−78843	12	3174.9	0.4			410	ns	50	(10^+)	03			IT=100	
^{138}Pm	−74940	27				*	10	s	2	1^+#	03			β^+=100	
^{138}Pm^m	−74911	13	30	30	BD	*	3.24	m	0.05	5^-#	03			β^+=100	
^{138}Pm^n			non existent		EU		3.24	m	0.05	(3^+)		81De38	I	β^+=100	*
^{138}Sm	−71498	12					3.1	m	0.2	0^+	03			β^+=100	
^{138}Eu	−61750	28					12.1	s	0.6	(6^-)	03			β^+=100	
^{138}Gd	−55780#	200#					4.7	s	0.9	0^+	03			β^+=100	
^{138}Gd^m	−53550#	200#	2232.7	1.1			6	μs	1	(8^-)	03				
^{138}Tb	−43630#	400#					800#	ms	(>200 ns)		03	00So11	I	β^+ ?; p=0	*
^{138}Dy	−34940#	600#					200#	ms		0^+				β^+ ?	

*^{138}La D : . . . ; β^+=65.6 5; β^-=34.4 5 **
*^{138}Pm^n D : arguments for a second isomer, of intermediate spin, are not convincing **
*^{138}Tb D : from 93Li40 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{139}Sb	−50320#	500#					300#	ms	(>300 ns)	$7/2^+$#	01	94Be24	I	β^- ?	
^{139}Te	−60800#	400#					500#	ms	(>300 ns)	$5/2^-$#	01	94Be24	I	β^- ?; β^-n ?	
^{139}I	−68840	30					2.282	s	0.010	$7/2^+$#	01	93Ru01	T	β^-=100; β^-n=10.0 3	*
^{139}Xe	−75644	21					39.68	s	0.14	$3/2^-$	01			β^-=100	
^{139}Cs	−80701	3					9.27	m	0.05	$7/2^+$	01			β^-=100	
^{139}Ba	−84913.7	0.4					83.1	m	0.3	$(7/2^-)$	01			β^-=100	
^{139}La	−87231.4	2.4					STABLE			$7/2^+$	01			IS=99.910 1	
^{139}Ce	−86952	7					137.641	d	0.020	$3/2^+$	01			ε=100	
^{139}Ce^m	−86198	7	754.24	0.08			56.54	s	0.13	$11/2^-$	01	94It.A	T	IT=100	
^{139}Pr	−84823	8					4.41	h	0.04	$5/2^+$	01			β^+=100	
^{139}Nd	−81992	26					29.7	m	0.5	$3/2^+$	01			β^+=100	
^{139}Nd^m	−81761	26	231.15	0.05			5.50	h	0.20	$11/2^-$	01			β^+=88.2 4; IT=11.8 4	
^{139}Pm	−77496	13					4.15	m	0.05	$(5/2)^+$	01			β^+=100	
^{139}Pm^m	−77307	13	188.7	0.3			180	ms	20	$(11/2)^-$	01			IT≈100; β^+=0.16#	
^{139}Sm	−72380	11					2.57	m	0.10	$1/2^+$	01			β^+=100	
^{139}Sm^m	−71923	11	457.40	0.22			10.7	s	0.6	$11/2^-$	01			IT=93.7 5; β^+=6.3 5	
^{139}Eu	−65398	13					17.9	s	0.6	$(11/2)^-$	01			β^+=100	
^{139}Gd	−57530#	200#				*	5.7	s	0.3	$9/2^-$#	01	99Xi04	T	β^+=100; β^+p=?	*
^{139}Gd^m	−57280#	250#	250#	150#		*	4.8	s	0.9	$1/2^+$#	01			β^+=100; β^+p=?	*
^{139}Tb	−48170#	300#					1.6	s	0.2	$11/2^-$#	01			β^+=100; β^+p ?	
^{139}Dy	−37690#	500#					600	ms	200	$7/2^+$#	01			β^+=100; β^+p ?	

*^{139}I T : average 93Ru01=2.280(0.011) 80Al15=2.29(0.02) **
*^{139}Gd T : average 99Xi04=5.8(0.9) 88Be.A=5.8(0.4); other 83Ni05=4.9(1.0) not used **
*^{139}Gd T : since it corresponds to a mixture of ground-state and isomer **
*^{139}Gd^m D : assuming that the delayed protons reported by 83Ni05 are from both states **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{140}Te	−56960#	300#				300#	ms	(>300 ns)	0^+	98	94Be24	I	β^- ?; β^-n ?	
^{140}I	−64270#	200#				860	ms	40	$(3)^{(-\#)}$	95			β^-=100; β^-n=9.3 10	
^{140}Xe	−72990	60				13.60	s	0.10	0^+	02			β^-=100	
^{140}Cs	−77051	8				63.7	s	0.3	1^-	95			β^-=100	
^{140}Ba	−83271	8				12.752	d	0.003	0^+	98			β^-=100	
^{140}La	−84321.0	2.4				1.6781	d	0.0003	3^-	95			β^-=100	
^{140}Ce	−88083.3	2.5				STABLE			0^+	95			IS=88.450 51	
^{140}Ce^m	−85975.5	2.5	2107.85	0.03		7.3	μs	1.5	6^+					
^{140}Pr	−84695	6				3.39	m	0.01	1^+	95			β^+=100	
^{140}Pr^m	−83932	6	763.3	0.7		3.05	μs	0.20	$(8)^-$					
^{140}Nd	−84252	28				3.37	d	0.02	0^+	95			ε=100	
^{140}Nd^m	−82031	28	2221.4	0.1		600	μs	50	7^-	95			IT=100	
^{140}Pm	−78210	40				9.2	s	0.2	1^+	95			β^+=100	
^{140}Pm^m	−77783	13	420	40	BD	5.95	m	0.05	8^-	95			β^+=100	
^{140}Sm	−75456	12				14.82	m	0.12	0^+	95			β^+=100	
^{140}Eu	−66990	50				1.51	s	0.02	1^+	95			β^+=100	
^{140}Eu^m	−66780	50	210	15		125	ms	2	5^-#	95	ABBW	E	IT≈100; β^+<1	*
^{140}Gd	−61782	28				15.8	s	0.4	0^+	95	91Fi03	T	β^+=100	
^{140}Tb	−50480	800				2.4	s	0.2	5	97			β^+=100; β^+p=0.26 13	
^{140}Dy	−42840#	500#				700#	ms		0^+	02			β^+ ?	
^{140}Dy^m	−40670#	500#	2166.1	0.5		7.0	μs	0.5	(8^-)	02			β^+ ?	
^{140}Ho	−29310#	500#				6	ms	3	8^+#	02			p=?; β^+=1#	

*^{140}Eu^m E : less than 50 keV above 185.3 level, from ENSDF, thus 185.3 + 25(15) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{141}Te	−51560#	400#				100#	ms	(>300 ns)	$5/2^-$#	01	94Be24	I	β^- ?; β^-n ?	
^{141}I	−60520#	200#				430	ms	20	$7/2^+$#	01			β^-=100; β^-n=21 3	
^{141}Xe	−68330	90				1.73	s	0.01	$5/2^{(-\#)}$	01			β^-=100; β^-n=0.044 5	
^{141}Cs	−74477	11				24.84	s	0.16	$7/2^+$	01			β^-=100; β^-n=0.035 3	
^{141}Ba	−79726	8				18.27	m	0.07	$3/2^-$	01			β^-=100	
^{141}La	−82938	5				3.92	h	0.03	$(7/2^+)$	01			β^-=100	
^{141}Ce	−85440.1	2.5				32.508	d	0.013	$7/2^-$	01			β^-=100	
^{141}Pr	−86020.9	2.5				STABLE			$5/2^+$	01			IS=100.	
^{141}Nd	−84198	4				2.49	h	0.03	$3/2^+$	01			β^+=100	
^{141}Nd^m	−83441	4	756.51	0.05		62.0	s	0.8	$11/2^-$	01	70Ab05	D	IT≈100; β^+=0.032 8	
^{141}Pm	−80523	14				20.90	m	0.05	$5/2^+$	01			β^+=100	
^{141}Pm^m	−79895	14	628.40	0.10		630	ns	20	$11/2^-$	01			IT=100	
^{141}Sm	−75939	9				10.2	m	0.2	$1/2^+$	01			β^+=100	
^{141}Sm^m	−75763	9	176.0	0.3		22.6	m	0.2	$11/2^-$	01			β^+≈100; IT=0.31 3	
^{141}Eu	−69927	13				40.7	s	0.7	$5/2^+$	01			β^+=100	
^{141}Eu^m	−69831	13	96.45	0.07		2.7	s	0.3	$11/2^-$	01			IT=86 3; β^+=14 3	
^{141}Gd	−63224	20				14	s	4	$(1/2^+)$	01			β^+=100; β^+p=0.03 1	
^{141}Gd^m	−62846	20	377.8	0.2		24.5	s	0.5	$(11/2^-)$	01			β^+=89 2; IT=11 2	
^{141}Tb	−54540	110			*	3.5	s	0.2	$(5/2^-)$	01			β^+=100	
^{141}Tb^m	−54540#	230#	0#	200#	EU *	7.9	s	0.6	$11/2^-$#	01	88Be.A	I	β^+=100	*
^{141}Dy	−45320#	300#				900	ms	200	$(9/2^-)$	01			β^+=100; β^+p=?	
^{141}Ho	−34370#	500#				4.1	ms	0.3	$(7/2^-)$	02			p=?; β^+=1#	
^{141}Ho^m	−34300#	500#	66	2		6.4	μs	0.8	$(1/2^+)$	02	01Se03	ET	p=100	*

*^{141}Tb^m I : existence discussed in 88Be.A. Provisionally accepted **

*^{141}Ho^m T : from 01Se03=6.5(+0.7–0.9) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{142}Te	−47430#	600#					50#	ms	(>300 ns)	0^+	00	94Be24	I	β^- ?	
^{142}I	−55720#	400#					200	ms		2^-#	00			β^-=100; β^-n=25#	
^{142}Xe	−65480	100					1.22	s	0.02	0^+	00	03Be05	TD	β^-=100; β^-n=0.36 3	
^{142}Cs	−70515	11					1.689	s	0.011	0^-	00	93Ru01	T	β^-=100; β^-n=0.090 4	∗
^{142}Ba	−77823	6					10.6	m	0.2	0^+	00			β^-=100	∗
^{142}La	−80035	6					91.1	m	0.5	2^-	00			β^-=100	
^{142}Ce	−84538.5	3.0					STABLE		(>50 Py)	0^+	00			IS=11.114 51; α ?; 2β^- ?	∗
^{142}Pr	−83792.7	2.5					19.12	h	0.04	2^-	00			$\beta^-\approx$100; ε=0.0164 8	
^{142}Pr^m	−83789.0	2.5	3.694	0.003			14.6	m	0.5	5^-	00			IT=100	
^{142}Nd	−85955.2	2.3					STABLE			0^+	00			IS=27.2 5	
^{142}Pm	−81157	25					40.5	s	0.5	1^+	00			β^+=100	
^{142}Pm^m	−80274	25	883.17	0.16			2.0	ms	0.2	$(8)^-$	00			IT=100	
^{142}Sm	−78993	6					72.49	m	0.05	0^+	00			β^+=100	
^{142}Eu	−71320	30					2.36	s	0.10	1^+	00	91Fi03	T	β^+=100	∗
^{142}Eu^m	−70856	12	460	30	BD		1.223	m	0.008	8^-	00			β^+=100	
^{142}Gd	−66960	28					70.2	s	0.6	0^+	00			β^+=100	
^{142}Tb	−57060#	300#					597	ms	17	1^+	00			β^+=100; β^+p=0.0022 11	
^{142}Tb^m	−56780#	300#	280.2	1.0			303	ms	17	(5^-)	00			IT≈100; β^+<0.5	
^{142}Dy	−49960#	360#					2.3	s	0.3	0^+	00			β^+=100; β^+p=0.06 3	
^{142}Ho	−37470#	500#					400	ms	100	$(6 to 9)$	02			$\beta^+\approx$100; β^+p=?; p≈0	

∗^{142}Cs T : average 93Ru01=1.684(0.014) 77Re05=1.70(0.02) ∗∗
∗^{142}Ba D : β^-n=0.091(0.003)% in ENSDF'00 contradicts $Q(\beta^-$n)=–2955(7) keV ∗∗
∗^{142}Ce T : lower limit is for α decay; for $\beta\beta$ decay 01Da22>260 Py ∗∗
∗^{142}Eu T : average 91Fi03=2.34(0.12) 75Ke08=2.4(0.2) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{143}I	−51640#	400#					100#	ms	(>300 ns)	$7/2^+$#	02	94Be24	I	β^- ?; β^-n=40#	
^{143}Xe	−60450#	200#					511	ms	6	$5/2^-$	02	03Be05	TD	β^-=100; β^-n=1.00 15	
^{143}Cs	−67671	24					1.791	s	0.007	$3/2^+$	02			β^-=100; β^-n=1.64 7	
^{143}Ba	−73936	13					14.5	s	0.3	$5/2^-$	02			β^-=100	
^{143}La	−78187	15					14.2	m	0.1	$(7/2)^+$	02			β^-=100	
^{143}Ce	−81612.0	3.0					33.039	h	0.006	$3/2^-$	02			β^-=100	
^{143}Pr	−83073.5	2.6					13.57	d	0.02	$7/2^+$	02			β^-=100	
^{143}Nd	−84007.4	2.3					STABLE			$7/2^-$	02			IS=12.2 2	
^{143}Pm	−82966	3					265	d	7	$5/2^+$	02			ε=100; e$^+$<5.7e–6	
^{143}Pm^m	−82006	3	959.73	0.13			24.0	ns	0.7	$11/2^-$	02			IT=100	
^{143}Sm	−79523	4					8.75	m	0.08	$3/2^+$	02			β^+=100	
^{143}Sm^m	−78769	4	753.99	0.16			66	s	2	$11/2^-$	02			IT≈100; β^+=0.24 6	
^{143}Sm^n	−76729	4	2793.8	0.13			30	ms	3	$23/2^{(-)}$	02			IT=100	
^{143}Eu	−74242	11					2.59	m	0.02	$5/2^+$	02			β^+=100	
^{143}Eu^m	−73852	11	389.51	0.04			50.0	μs	0.5	$11/2^-$	02			IT=100	
^{143}Gd	−68230	200					39	s	2	$(1/2)^+$	02	78Fi02	D	β^+=100; β^+p=?; $\beta^+\alpha$=?	∗
^{143}Gd^m	−68080	200	152.6	0.5			110.0	s	1.4	$(11/2^-)$	02	78Fi02	D	β^+=100; β^+p=?; $\beta^+\alpha$=?	
^{143}Tb	−60430	60				∗	12	s	1	$(11/2^-)$	01			β^+=100	
^{143}Tb^m	−60430#	120#	0#	100#		∗	< 21	s		$5/2^+$#	01			β^+ ?	
^{143}Dy	−52320#	200#					5.6	s	1.0	$(1/2^+)$	01	03Xu04	TJ	β^+=100; β^+p=?	∗
^{143}Dy^m	−52010#	200#	310.7	0.6			3.0	s	0.3	$(11/2^-)$	01	03Xu04	JTD	β^+=100; β^+p=?	
^{143}Ho	−42280#	400#					300#	ms	(>200 ns)	$11/2^-$#	01	00So11	I	β^+ ?	
^{143}Er	−31350#	600#					200#	ms		$9/2^-$#				β^+ ?	

∗^{143}Gd D : 78Fi02: β^+p and/or $\beta^+\alpha$ for ^{143}Gd+^{143}Gd^m=0.001%, 39 particles detected ∗∗
∗^{143}Dy T : others: 84Ni03=3.2(0.6) 83Ni05=4.1(0.3) in two different experiments ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{144}I	−46580#	500#				50#	ms	(>300 ns)	1^-#	01	94Be24	I	β^- ?; β^-n=40#	
^{144}Xe	−57280#	300#				388	ms	7	0^+	01	03Be05	TD	β^-=100; β^-n=3.0 3	
^{144}Cs	−63270	26			*	994	ms	4	$1^{(-\#)}$	01			β^-=100; β^-n=3.20 21	
^{144}Cs^m	−62970#	200#	300#	200#	*	< 1	s		(> 3)	01			β^-=?; IT ?	
^{144}Ba	−71769	13				11.5	s	0.2	0^+	01			β^-=100	*
^{144}La	−74890	50				40.8	s	0.4	(3^-)	01			β^-=100	
^{144}Ce	−80437	3				284.91	d	0.05	0^+	01			β^-=100	
^{144}Pr	−80756	3				17.28	m	0.05	0^-	01			β^-=100	
^{144}Pr^m	−80697	3	59.03	0.03		7.2	m	0.3	3^-	01			IT≈100; β^-=0.07	
^{144}Nd	−83753.2	2.3				2.29	Py	0.16	0^+	01			IS=23.8 3; α=100	
^{144}Pm	−81421	3				363	d	14	5^-	01	94Hi05	D	ε=100; e$^+$<8e–5	
^{144}Pm^m	−80580	3	840.90	0.05		780	ns	200	$(9)^+$	01			IT=100	
^{144}Pm^n	−72825	4	8595.8	2.2		2.7	μs		(27^+)	01			IT=100	
^{144}Sm	−81972.0	2.8				STABLE			0^+	01			IS=3.07 7; 2β^+ ?; α ?	
^{144}Sm^m	−79648.4	2.8	2323.60	0.08		880	ns	25	6^+	01			IT=100	
^{144}Eu	−75622	11				10.2	s	0.1	1^+	01			β^+=100	
^{144}Eu^m	−74494	11	1127.6	0.6		1.0	μs	0.1	(8^-)	01			IT=100	
^{144}Gd	−71760	28				4.47	m	0.06	0^+	01			β^+=100	
^{144}Tb	−62368	28				1	s		1^+	01			β^+=100; β^+p ?	
^{144}Tb^m	−61971	28	396.9	0.5		4.25	s	0.15	(6^-)	01			IT=66; β^+=34; β^+p ?	
^{144}Tb^n	−61892	28	476.2	0.5		2.8	μs	0.3	(8^-)	01			IT=100	
^{144}Tb^p	−61851	28	517.1	0.5		670	ns	60	(9^+)	01			IT=100	
^{144}Dy	−56580	30				9.1	s	0.4	0^+	01			β^+=100; β^+p=?	
^{144}Ho	−45200#	300#				700	ms	100		01			β^+=100; β^+p=?	
^{144}Er	−36910#	400#				400#	ms	(>200 ns)	0^+	01	00So11	I	β^+ ?	

*^{144}Ba D : β^-n=3.6 7 in ENSDF'01 belongs in fact to ^{144}Cs **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{145}Xe	−52100#	300#				188	ms	4	$3/2^-$#	97	03Be05	TD	β^-=100; β^-n=5.0 6	
^{145}Cs	−60057	11				582	ms	6	$3/2^+$	93	93Ru01	TD	β^-=100; β^-n=14.3 8	*
^{145}Ba	−67410	70				4.31	s	0.16	$5/2^-$	98			β^-=100	
^{145}La	−72990	90				24.8	s	2.0	$(5/2^+)$	98	96Ur02	J	β^-=100	
^{145}Ce	−77100	40				3.01	m	0.06	$(3/2)^-$	93			β^-=100	
^{145}Pr	−79632	7				5.984	h	0.010	$7/2^+$	93			β^-=100	
^{145}Nd	−81437.1	2.3				STABLE			$7/2^-$	93			IS=8.3 1	
^{145}Pm	−81274	3				17.7	y	0.4	$5/2^+$	93			ε=100; α=2.8e–7	
^{145}Sm	−80657.7	2.8				340	d	3	$7/2^-$	02			ε=100	
^{145}Sm^m	−71871.5	2.9	8786.2	0.7		990	ns	170	$(49/2^+)$	02			IT=100	
^{145}Eu	−77998	4				5.93	d	0.04	$5/2^+$	93			β^+=100	
^{145}Eu^m	−77282	4	716.0	0.3		490	ns		$11/2^-$	93			IT=100	
^{145}Gd	−72927	19				23.0	m	0.4	$1/2^+$	01			β^+=100	
^{145}Gd^m	−72178	19	749.1	0.2		85	s	3	$11/2^-$	01			IT=94.3 5; β^+=5.7 5	
^{145}Tb	−65880	60			*	20#	m		$(3/2^+)$	96	93To04	J	β^+ ?	
^{145}Tb^m	−65880#	120#	0#	100#	*	30.9	s	0.7	$(11/2^-)$	96	93Al03	T	β^+=100	*
^{145}Dy	−58290	50				9.5	s	1.0	$(1/2^+)$	93	93Al03	T	β^+=100; β^+p=?	*
^{145}Dy^m	−58170	50	118.2	0.2		14.1	s	0.7	$(11/2^-)$	93	93To04	T	β^+=100	*
^{145}Ho	−49180#	300#			*	2.4	s	0.1	$(11/2^-)$	93			β^+=100	
^{145}Ho^m	−49080#	320#	100#	100#	*	100#	ms		$5/2^+$#				β^+ ?; IT ?	
^{145}Er	−39690#	400#				900	ms	300	$1/2^+$#	98			β^+=100; β^+p=?	
^{145}Tm	−27880#	400#				3.1	μs	0.3	$(11/2^-)$	02	98Ba13	TJ	p=100	*

*^{145}Cs T : average 93Ru01=579(6) 82Ra13=594(13) **
*^{145}Tb^m T : average 93Al03=31.6(0.6) 82No08=29.5(1.0) and 82Al07=29.5(1.5) **
*^{145}Dy T : average 93Al03=10.5(1.5) 93To04=6(2) and 84Sc.C=10(1) **
*^{145}Dy^m T : average 93To04=14.5(1.0) 82No08=13.6(1.0) **
*^{145}Tm T : average 03Ka04=3.1(0.3) 98Ba13=3.5(1.0) J : not adopted by ENSDF'02 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{146}Xe	−48670#	400#					146	ms	6	0^+	97	03Be05	TD	β^-=100; β^-n=6.9 15	
^{146}Cs	−55620	70					323	ms	6	1^-	97	93Ru01	T	β^-=100; β^-n=14.2 5	*
^{146}Ba	−65000	70					2.22	s	0.07	0^+	97	93Ru01	D	β^-=100	*
^{146}La	−69120	70				*	6.27	s	0.10	2^-	97	93Ru01	D	β^-=100	*
^{146}La^m	−68990	150	130	130		*	10.0	s	0.1	(6^-)	97	79Ke02	E	β^-=100	*
^{146}Ce	−75680	70					13.52	m	0.13	0^+	97			β^-=100	
^{146}Pr	−76710	60					24.15	m	0.18	$(2)^-$	97			β^-=100	
^{146}Nd	−80931.1	2.3					STABLE			0^+	97			IS=17.2 3; 2β^- ?; α ?	
^{146}Pm	−79460	5					5.53	y	0.05	3^-	99			ε=66.0 13; β^-=34.0 13	
^{146}Sm	−81002	4					103	My	5	0^+	97			α=100	
^{146}Eu	−77122	6					4.61	d	0.03	4^-	97			β^+=100	
^{146}Eu^m	−76456	6	666.37	0.16			235	μs	3	9^+	97			IT=100	
^{146}Gd	−76093	5					48.27	d	0.10	0^+	01			ε=100	
^{146}Tb	−67770	50				*	8	s	4	1^+	97			β^+=100	
^{146}Tb^m	−67620#	110#	150#	100#		*	24.1	s	0.5	5^-	97	93Al03	T	β^+=100	
^{146}Tb^n	−66840#	110#	930#	100#			1.18	ms	0.02	(10^+)	97			IT=100	*
^{146}Dy	−62554	27					33.2	s	0.7	0^+	97	93Al03	T	β^+=100	
^{146}Dy^m	−59618	27	2935.7	0.6			150	ms	20	10^+#	97			IT=100	
^{146}Ho	−51570#	200#					3.6	s	0.3	(10^+)	97			β^+=100; β^+p=?	
^{146}Er	−44710#	300#					1.7	s	0.6	0^+	97	93To05	D	β^+=100; β^+p=?	
^{146}Tm	−31280#	400#					240	ms	30	(6^-)	02			p≈100; β^+ ?	
^{146}Tm^m	−31200#	400#	71	6	p		72	ms	23	(10^+)	02			p=?; β^+=16#	

*^{146}Cs T : average 93Ru01=321(2) 76Lu02=343(7) **
*^{146}Ba D : 93Ru01 β^-n<0.02% is not relevant since $Q(\beta^-\text{n})$ is negative: =–190(100) **
*^{146}La D : 93Ru01 β^-n<0.007% is not relevant since $Q(\beta^-\text{n})$ is negative: =–180(80) **
*^{146}La^m E : derived from $Q(^{146}\text{La}^m)$=6660(120) in 79Ke02 **
*^{146}Tb^n E : 779.6 keV above ^{146}Tb^m, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{147}Xe	−43260#	400#					130	ms	80	$3/2^-$#	98	03Be05	TD	β^-=100; β^-n=4.0 23	*
^{147}Cs	−52020	50					225	ms	5	$(3/2^+)$	92	93Ru01	D	β^-=100; β^-n=28.5 17	
^{147}Ba	−60600#	210#					893	ms	1	$(3/2^+)$	98	93Ru01	D	β^-=100	*
^{147}La	−66850	50					4.015	s	0.008	$(5/2^+)$	98	93Ru01	D	β^-=100; β^-n=0.040 3	*
^{147}Ce	−72030	30					56.4	s	1.0	$(5/2^-)$	92			β^-=100	
^{147}Pr	−75455	23					13.4	m	0.4	$(3/2^+)$	92			β^-=100	
^{147}Nd	−78151.9	2.3					10.98	d	0.01	$5/2^-$	92			β^-=100	
^{147}Pm	−79047.9	2.4					2.6234	y	0.0002	$7/2^+$	96			β^-=100	
^{147}Sm	−79272.1	2.4					106.0	Gy	1.1	$7/2^-$	92	70Gu14	T	IS=14.99 18; α=100	*
^{147}Eu	−77550	3					24.1	d	0.6	$5/2^+$	99			β^+≈100; α=0.0022 6	
^{147}Gd	−75363	3					38.06	h	0.12	$7/2^-$	99			β^+=100	
^{147}Gd^m	−66775	3	8587.8	0.4			510	ns	20	$(49/2^+)$	99			IT=100	
^{147}Tb	−70752	12					1.64	h	0.03	$1/2^+$#	99	97Wa04	T	β^+=100	
^{147}Tb^m	−70701	12	50.6	0.9			1.87	m	0.05	$(11/2)^-$	99	93Al03	T	β^+=100	*
^{147}Dy	−64188	20					40	s	10	$1/2^+$	92	84To07	D	β^+=100; β^+p≈0.05	
^{147}Dy^m	−63438	20	750.5	0.4			55	s	1	$11/2^-$	92			β^+=65 4; IT=35 4	
^{147}Ho	−55837	28					5.8	s	0.4	$(11/2^-)$	92			β^+=100; β^+p ?	
^{147}Er	−47050#	300#				* &	2.5	s		$(1/2^+)$	92			β^+=100; β^+p=?	
^{147}Er^m	−46950#	300#	100#	50#		* &	2.5	s	0.2	$(11/2^-)$	92			β^+=100	*
^{147}Tm	−36370#	300#					580	ms	30	$11/2^-$	02			β^+=85 5; p=15 5	
^{147}Tm^m	−36300#	300#	60	5	p		360	μs	40	$3/2^+$	02			p=100	

*^{147}Xe D : from β^-n<8% **
*^{147}Ba D : 93Ru01 β^-n=0.06(3)% contradicts $Q(\beta^-\text{n})$=–340(120) **
*^{147}La J : from 96Ur02 **
*^{147}Sm T : average 70Gu14=106(2) 65Va16=108(2) 64Do01=104(3) 61Wr02=105(2) **
*^{147}Tb^m T : average 93Al03=1.92(0.07) 73Bo13=1.83(0.06) E : from 87Li09 **
*^{147}Er^m E : estimated from $11/2^-$ level in isotones ^{141}Sm=175 ^{143}Gd=152 ^{145}Dy=118 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{148}Cs	−47300	580				146	ms	6		00			β^-=100; β^-n=25.1 25	
^{148}Ba	−58010	80				612	ms	17	0^+	00			β^-=100; β^-n=0.4 3	
^{148}La	−63130	60				1.26	s	0.08	(2^-)	00			β^-=100; β^-n=0.15 3	
^{148}Ce	−70391	29				56	s	1	0^+	00			β^-=100	
^{148}Pr	−72531	26			*	2.29	m	0.02	1^-	00			β^-=100	
^{148}Pr^m	−72480#	40#	50#	30#	*	2.01	m	0.07	(4)	00	ABBW	E	β^-=100	*
^{148}Nd	−77413.4	2.8				STABLE		(>3.0 Ey)	0^+	00	82Be20	T	IS=5.7 1; 2β^- ?; α ?	
^{148}Pm	−76872	6				5.368	d	0.002	1^-	00			β^-=100	
^{148}Pm^m	−76734	6	137.9	0.3		41.29	d	0.11	$5^-,6^-$	00			β^-=95.8 6; IT=4.2 6	
^{148}Sm	−79342.2	2.4				7	Py	3	0^+	00			IS=11.24 10; α=100	
^{148}Eu	−76302	10				54.5	d	0.5	5^-	00			β^+=100; α=9.4e–7 28	
^{148}Gd	−76275.8	2.8				74.6	y	3.0	0^+	00			α=100; 2β^+ ?	
^{148}Tb	−70540	14				60	m	1	2^-	00			β^+=100	
^{148}Tb^m	−70450	14	90.1	0.3		2.20	m	0.05	$(9)^+$	00			β^+=100	
^{148}Tb^n	−61921	14	8618.6	1.0		1.310	μs	0.007	(27^+)	00			IT=100	
^{148}Dy	−67859	11				3.3	m	0.2	0^+	00			β^+=100	
^{148}Ho	−58020	130				2.2	s	1.1	(1^+)	00			β^+=100	
^{148}Ho^m	−57620#	160#	400#	100#		9.49	s	0.12	$(6)^-$	00	93Al03	T	β^+=100; β^+p=0.08 1	*
^{148}Ho^n	−57330#	160#	690#	100#		2.35	ms	0.04	(10^+)	00			IT=100	*
^{148}Er	−51650#	200#				4.6	s	0.2	0^+	00			β^+=100; β^+p≈0.15	
^{148}Tm	−39270#	400#				700	ms	200	(10^+)	00			β^+=100	
^{148}Yb	−30350#	600#				250#	ms		0^+				β^+ ?	

*^{148}Pr^m E : derived from ENSDF estimate E<90 keV **
*^{148}Ho^m T : average 93Al03=9.30(0.20) 89Ta11=9.59(0.15) **
*^{148}Ho^n E : 694.4 keV above ^{148}Ho^m, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{149}Cs	−43850#	200#				150#	ms	(>50 ms)	$3/2^+$#	95	87Ra12	I	β^- ?; β^-n ?	
^{149}Ba	−53490#	200#				344	ms	7	$3/2^-$#	95			β^-=100; β^-n=0.43 12	
^{149}La	−60800#	320#				1.05	s	0.03	$5/2^+$#	95	93Ru01	D	β^-=100; β^-n=1.4 3	
^{149}Ce	−66700	100				5.3	s	0.2	$3/2^-$#	98			β^-=100	
^{149}Pr	−71060	80				2.26	m	0.07	$(5/2^+)$	95			β^-=100	
^{149}Nd	−74380.9	2.8				1.728	h	0.001	$5/2^-$	95			β^-=100	
^{149}Pm	−76071	4				53.08	h	0.05	$7/2^+$	95			β^-=100	
^{149}Pm^m	−75831	4	240.214	0.007		35	μs	3	$11/2^-$					
^{149}Sm	−77141.9	2.4				STABLE		(>2 Py)	$7/2^-$	95			IS=13.82 7; α ?	
^{149}Eu	−76447	4				93.1	d	0.4	$5/2^+$	95			ε=100	
^{149}Gd	−75133	4				9.28	d	0.10	$7/2^-$	01			β^+=100; α=4.3e–4 10	
^{149}Tb	−71496	4				4.118	h	0.025	$1/2^+$	99			β^+=83.3 17; α=16.7 17	
^{149}Tb^m	−71460	4	35.78	0.13		4.16	m	0.04	$11/2^-$	99			β^+≈100; α=0.022 3	
^{149}Dy	−67715	9				4.20	m	0.14	$7/2^{(-)}$	95	88Ah02	J	β^+=100	
^{149}Dy^m	−65054	9	2661.1	0.4		490	ms	15	$(27/2^-)$	95			IT=99.3 3; β^+=0.7 3	
^{149}Dy^n	−60230	30	7490	30		28	ns	2	$(47/2^+)$	95			IT=100	*
^{149}Ho	−61688	18				21.1	s	0.2	$(11/2^-)$	95			β^+=100	
^{149}Ho^m	−61639	18	48.80	0.20		56	s	3	$(1/2^+)$	95			β^+=100	
^{149}Er	−53742	28				4	s	2	$(1/2^+)$	95			β^+=100; β^+p=7 2	
^{149}Er^m	−53000	28	741.8	0.2		8.9	s	0.2	$(11/2^-)$	95			β^+=96.5 7; IT=3.5 7;...	*
^{149}Tm	−44040#	300#				900	ms	200	$(11/2^-)$	95			β^+=100; β^+p=0.26 15	
^{149}Yb	−33500#	500#				700	ms	200	$(1/2^+,3/2^+)$	95	01Xu06	TD	β^+=100; β^+p=?	

*^{149}Dy^n E : 7409.9 above level at ≈80 keV **
*^{149}Er^m D : . . . ; β^+p=0.18 7 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{150}Cs	−38960#	300#				100#	ms	(>50 ms)		97	87Ra12	I	β^- ?; β^-n ?	
^{150}Ba	−50600#	400#				300	ms		0^+	95			β^-=100; β^-n ?	
^{150}La	−57040#	400#				510	ms	30	(3^+)	97	95Ok02	TJ	β^-=100; β^-n=2.7 3	
^{150}Ce	−64820	50				4.0	s	0.6	0^+	95			β^-=100	
^{150}Pr	−68304	26				6.19	s	0.16	$(1)^-$	96			β^-=100	
^{150}Nd	−73690	3				6.7	Ey	0.7	0^+	96	97De40	TD	IS=5.6 2; 2β^-=100	*
^{150}Pm	−73603	20				2.68	h	0.02	(1^-)	95			β^-=100	

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{150}Sm	−77057.3	2.4					STABLE			0^+	96		IS=7.38 1	
^{150}Eu	−74797	6					36.9	y	0.9	$5^{(-)}$	95		β^+=100	
^{150}Eu^m	−74755	6	42.1	0.5			12.8	h	0.1	0^-	95		β^-=89 2; β^+=11 2; . . .	*
^{150}Gd	−75769	6					1.79	My	0.08	0^+	96		α=100; 2β^+ ?	
^{150}Tb	−71111	8					3.48	h	0.16	(2^-)	96		$\beta^+\approx$100; α<0.05	
^{150}Tb^m	−70654	28	457	29	MD		5.8	m	0.2	9^+	96		$\beta^+\approx$100; IT ?	
^{150}Dy	−69317	5					7.17	m	0.05	0^+	96		β^+=64 5; α=36 5	
^{150}Ho	−61948	14				*	76.8	s	1.8	2^-	95	93Al03 T	β^+=100	*
^{150}Ho^m	−61960	50	−10	50	BD	*	23.3	s	0.3	$(9)^+$	95		β^+=100	
^{150}Ho^n	−61960	50	8000				751	ns						
^{150}Er	−57833	17					18.5	s	0.7	0^+	95		β^+=100	
^{150}Tm	−46610#	200#				* &	3#	s		(1^+)		88Ni02 J	β^+=100	
^{150}Tm^m	−46470#	240#	140#	140#		* &	2.20	s	0.06	(6^-)	95	96Ga24 T	β^+=100; β^+p=1.2 3	*
^{150}Tm^n	−45800#	240#	810#	140#			5.2	ms	0.3	(10^+)	95		IT=100	*
^{150}Yb	−38730#	400#					700#	ms	(>200 ns)	0^+	97	00So11 I	β^+ ?	
^{150}Lu	−24940#	500#					46	ms	6	$(5^-,6^-)$	02	00Gi01 J	p=?; β^+=30#	
^{150}Lu^m	−24900#	500#	34	15	p		80	μs	60	$(1^+,2^+)$	02	00Gi01 J	p$\approx$100; β^+ ?	

*^{150}Nd T : from 6.75(+0.37–0.68 statistics + 0.68 systematics) **
*^{150}Eu^m D : . . . ; IT≤5e–8 **
*^{150}Ho T : average 93Al03=78(2) 82No08=72(4) **
*^{150}Tm^m T : average 96Ga24=2.22(0.07) 88Ni02=2.15(0.10) and 87To05=2.2(0.2) **
*^{150}Tm^m T : 82No08=3.5(0.6) at variance, not used D : from 88Ni02 **
*^{150}Tm^n E : 671.6 keV above ^{150}Tm^m, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference	Decay modes and intensities (%)	
^{151}Cs	−35220#	500#					60#	ms	(>50 ms)	$3/2^+$#	97	87Ra12 I	β^- ?; β^-n ?	
^{151}Ba	−45820#	400#					200#	ms	(>300 ns)	$3/2^-$#	97	94Be24 I	β^- ?	
^{151}La	−54290#	400#					300#	ms	(>300 ns)	$5/2^+$#	97	94Be24 I	β^- ?	
^{151}Ce	−61500	100					1.02	s	0.06	$3/2^-$#	97		β^-=100	
^{151}Pr	−66771	23					18.90	s	0.07	$(3/2)^{(-\#)}$	97		β^-=100	
^{151}Nd	−70953	3					12.44	m	0.07	$3/2^+$	97		β^-=100	
^{151}Pm	−73395	5					28.40	h	0.04	$5/2^+$	97		β^-=100	
^{151}Sm	−74582.5	2.4					90	y	8	$5/2^-$	97		β^-=100	
^{151}Sm^m	−74321.4	2.4	261.13	0.04			1.4	μs	0.1	$(11/2)^-$	97		IT=100	
^{151}Eu	−74659.1	2.5					STABLE			$5/2^+$	97		IS=47.81 3	
^{151}Eu^m	−74462.9	2.5	196.245	0.010			58.9	μs	0.5	$11/2^-$	97			
^{151}Gd	−74195	4					124	d	1	$7/2^-$	97		ε=100; α=1.0e–6 6	
^{151}Tb	−71630	5					17.609	h	0.001	$1/2^{(+)}$	99		$\beta^+\approx$100; α=0.0095 15	
^{151}Tb^m	−71530	5	99.54	0.06			25	s	3	$(11/2^-)$	99		IT=93.8 4; β^+=6.2 4	
^{151}Dy	−68759	4					17.9	m	0.3	$7/2^{(-)}$	99		β^+=?; α=5.6 4	
^{151}Ho	−63632	12					35.2	s	0.1	$11/2^{(-)}$	97	87Ne.A J	β^+=?; α=22 3	
^{151}Ho^m	−63591	12	41.0	0.2			47.2	s	1.0	$1/2^{(+)}$	97	87Ne.A J	α=77 18; β^+ ?	
^{151}Er	−58266	16					23.5	s	1.3	$(7/2^-)$	97		β^+=100	
^{151}Er^m	−55681	16	2585.5	0.6			580	ms	20	$(27/2^-)$	97		IT=95.3 3; β^+=4.7 3	
^{151}Tm	−50782	20				&	4.17	s	0.10	$(11/2^-)$	97		β^+=100	
^{151}Tm^m	−50690	21	92	7	AD	&	6.6	s	1.4	$(1/2^+)$	97		β^+=100	
^{151}Tm^n	−48126	20	2655.67	0.22			451	ns	24	$(27/2^-)$	97		IT=100	
^{151}Yb	−41540	300					1.6	s	0.5	$(1/2^+)$	97	86To12 T	β^+=100; β^+p=?	*
^{151}Yb^m	−40790#	320#	750#	100#			1.6	s	0.5	$(11/2^-)$	97	86To12 TD	$\beta^+\approx$100; β^+p=?; IT=0.4#	*
^{151}Yb^n	−39750#	580#	1790#	500#			2.6	μs	0.7	$19/2^-$#	97		IT=100	*
^{151}Yb^p	−39090#	580#	2450#	500#			20	μs	1	$27/2^-$#	97		IT=100	*
^{151}Lu	−30200#	400#					80.6	ms	1.9	$(11/2^-)$	02	93Se04 D	p=?; β^+=37#	*
^{151}Lu^m	−30130#	400#	77	5	p		16	μs	1	$(3/2^+)$	02		p=?; β^+ ?	

*^{151}Yb T : derived from 1.6(0.1), for mixture of ground-state and isomer with almost same half-life **
*^{151}Yb^m E : 740# estimated by 90Ak01 (see ENSDF'97) **
*^{151}Yb^n E : 1791.2 keV above ^{151}Yb^m (see ENSDF'97) **
*^{151}Yb^p E : 2448 keV above ^{151}Yb^m (see ENSDF'97) **
*^{151}Lu D : p=63.4(0.9)% in ENSDF'02, based on predicted beta-decay half-life≈220 ms **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{152}Ba	−42600#	500#				100#	ms		0^+	97			β^- ?	
^{152}La	−50070#	400#				200#	ms (>300 ns)			97	94Be24	I	β^- ?	
^{152}Ce	−59110#	200#				1.1	s	0.3	0^+	97	90Ta07	T	β^-=100	*
^{152}Pr	−63810	120				3.63	s	0.12	4^+	97	99To04	J	β^-=100	
^{152}Nd	−70158	25				11.4	m	0.2	0^+	97			β^-=100	
^{152}Pm	−71262	26			*	4.12	m	0.08	1^+	97			β^-=100	
^{152}Pm^m	−71120	80	140	90	BD *	7.52	m	0.08	4^-	97			β^-=100	
^{152}Pm^n	−71010#	150#	250#	150#	*	13.8	m	0.2	(8)	97			$\beta^-\approx$100; IT=?	*
^{152}Sm	−74768.8	2.5				STABLE			0^+	97			IS=26.75 16	
^{152}Eu	−72894.5	2.5				13.537	y	0.006	3^-	97			β^+=72.1 3; β^-=27.9 3	
^{152}Eu^m	−72848.9	2.5	45.5998	0.0004		9.3116	h	0.0013	0^-	97			β^-=72 4; β^+=28 4	
^{152}Eu^n	−72746.6	2.5	147.86	0.10		96	m	1	8^-	97			IT=100	
^{152}Gd	−74714.2	2.5				108	Ty	8	0^+	97			IS=0.20 1; α=100; 2β^+ ?	
^{152}Tb	−70720	40				17.5	h	0.1	2^-	98			β^+=100; α<7e–7	
^{152}Tb^m	−70220	40	501.74	0.19		4.2	m	0.1	8^+	98			IT=78.8 8; β^+=21.2 8	
^{152}Dy	−70124	5				2.38	h	0.02	0^+	99			$\varepsilon\approx$100; α=0.100 7	
^{152}Ho	−63608	14				161.8	s	0.3	2^-	97			β^+=88 3; α=12 3	
^{152}Ho^m	−63448	14	160	1		50.0	s	0.4	9^+	97			β^+=89.2 17; α=10.8 17	
^{152}Ho^n	−60588	14	3019.59	0.19		8.4	μs	0.3	19^-	97			IT=100	
^{152}Er	−60500	11				10.3	s	0.1	0^+	97			α=90 4; β^+=10 4	
^{152}Tm	−51770	70			*	8.0	s	1.0	$(2\#)^-$	97			β^+=100	
^{152}Tm^m	−51670#	110#	100#	80#	*	5.2	s	0.6	$(9)^+$	97			β^+=100	
^{152}Yb	−46310	210				3.04	s	0.06	0^+	97			β^+=100; β^+p ?	
^{152}Lu	−33420#	200#				650	ms	70	$(5^-,6^-)$	97	88Ni02	T	β^+=100; β^+p=15 7	*

*^{152}Ce T : average 90Ta07=1.4(0.2) 91Ay.A=0.8(0.3) **
*^{152}Pm^n E : ENSDF: "Probably feeds 7.52 m level" at 140 keV **
*^{152}Lu T : average 88Ni02=600(100) 87To02=700(100) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{153}Ba	−37620#	800#				80#	ms		$5/2^-$#				β^- ?	
^{153}La	−46930#	600#				150#	ms (>300 ns)		$5/2^+$#	98	94Be24	I	β^- ?	
^{153}Ce	−55350#	400#				500#	ms (>300 ns)		$3/2^-$#	98	94Be24	I	β^- ?	
^{153}Pr	−61630	100				4.28	s	0.11	$5/2^-$#	98			β^-=100	
^{153}Nd	−67349	27				31.6	s	1.0	$(3/2)^-$	98			β^-=100	
^{153}Pm	−70685	11				5.25	m	0.02	$5/2^-$	98			β^-=100	
^{153}Sm	−72565.8	2.5				46.284	h	0.004	$3/2^+$	98			β^-=100	*
^{153}Sm^m	−72467.4	2.5	98.37	0.10		10.6	ms	0.3	$11/2^-$	98			IT=100	
^{153}Eu	−73373.5	2.5				STABLE			$5/2^+$	98			IS=52.19 3	
^{153}Gd	−72889.8	2.5				240.4	d	1.0	$3/2^-$	98			ε=100	
^{153}Gd^m	−72794.6	2.5	95.1737	0.0012		3.5	μs	0.4	$(9/2^+)$	98			IT=100	
^{153}Gd^n	−72718.6	2.5	171.189	0.005		76.0	μs	1.4	$(11/2^-)$	98			IT=100	
^{153}Tb	−71320	4				2.34	d	0.01	$5/2^+$	98			β^+=100	
^{153}Tb^m	−71157	4	163.175	0.005		186	μs	4	$11/2^-$	98			IT=100	
^{153}Dy	−69150	5				6.4	h	0.1	$7/2^{(-)}$	99			$\beta^+\approx$100; α=0.0094 14	
^{153}Ho	−65019	6				2.01	m	0.03	$11/2^-$	98			$\beta^+\approx$100; α=0.051 25	
^{153}Ho^m	−64950	6	68.7	0.3		9.3	m	0.5	$1/2^+$	98			$\beta^+\approx$100; α=0.18 8	
^{153}Er	−60488	9				37.1	s	0.2	$7/2^{(-)}$	98	85Ah.1	J	α=53 3; β^+=47 3	*
^{153}Tm	−54015	18				1.48	s	0.01	$(11/2^-)$	98			α=91 3; β^+=9 3	
^{153}Tm^m	−53972	18	43.2	0.2		2.5	s	0.2	$(1/2^+)$	98			α=92 3; β^+=?	
^{153}Yb	−47060#	200#				4.2	s	0.2	$7/2^-$#	98	88Wi05	D	β^+=?; α=50#; ...	*
^{153}Yb^m	−44360#	220#	2700	100		15	μs	1	$(27/2^-)$	98				*
^{153}Lu	−38410	210				900	ms	200	$11/2^-$	98	97Ir01	D	α=70#; β^+=?; p=0	*
^{153}Lu^m	−38330	210	80	5		1#	s		$1/2^+$	98	97Ir01	ED	β^+ ?; α ?; p=0	
^{153}Lu^n	−35780	210	2632.9	0.5		15	μs	3	$27/2^-$	98				
^{153}Hf	−27300#	500#				400#	ms (>200 ns)		$1/2^+$#		00So11	I	β^+ ?	
^{153}Hf^m	−26550#	510#	750#	100#		500#	ms		$11/2^-$#				β^+ ?; IT ?	

*^{153}Sm T : see also 99Sc12=46.274(7) **
*^{153}Er J : and 89Ot.A **
*^{153}Yb D : ...; β^+p=0.008 2 **
*^{153}Yb^m E : in ENSDF 2578.2 + x **
*^{153}Lu D : p decay is from 97Ir01 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{154}La	−42380#	600#					100#	ms						β^- ?	
^{154}Ce	−52700#	500#					300#	ms	(>300 ns)	0^+	98	94Be24	I	β^- ?	
^{154}Pr	−58200	150					2.3	s	0.1	$(3^+,2^+)$	98			β^-=100	
^{154}Nd	−65690	110					25.9	s	0.2	0^+	98			β^-=100	
^{154}Nd^m	−65210#	190#	480#	150#			1.3	μs	0.5		98				
^{154}Nd^n	−64340	110	1349	10			> 1	μs		(5^-)	98				
^{154}Pm	−68500	40				∗ &	1.73	m	0.10	$(0,1)$	98			β^-=100	
^{154}Pm^m	−68380	110	120	120	BD	∗ &	2.68	m	0.07	$(3,4)$	98			β^-=100	
^{154}Sm	−72461.6	2.5					STABLE		(>2.3 Ey)	0^+	98			IS=22.75 29; 2β^- ?	
^{154}Eu	−71744.4	2.5					8.593	y	0.004	3^-	98			$\beta^-\approx$100; ε=0.02 1	
^{154}Eu^m	−71599.1	2.5	145.3	0.3			46.3	m	0.4	(8^-)	98			IT=100	
^{154}Gd	−73713.2	2.5					STABLE			0^+	98			IS=2.18 3	
^{154}Tb	−70160	50				∗	21.5	h	0.4	$0^{(+\#)}$	98			$\beta^+\approx$100; β^-<0.1	
^{154}Tb^m	−70150	50	12	7		∗	9.4	h	0.4	3^-	98	ABBW	E	β^+=78.2 7; IT=21.8 7;...	∗
^{154}Tb^n	−69960#	160#	200#	150#		∗	22.7	h	0.5	7^-	98			β^+=98.2 6; IT=1.8 6	
^{154}Dy	−70398	8					3.0	My	1.5	0^+	99			α=100; 2β^+ ?	
^{154}Ho	−64644	8					11.76	m	0.19	2^-	98			$\beta^+\approx$100; α=0.019 5	
^{154}Ho^m	−64406	28	238	30	AD		3.10	m	0.14	8^+	98			β^+=100; α<0.001; IT$\approx$0	
^{154}Er	−62612	5					3.73	m	0.09	0^+	01			$\beta^+\approx$100; α=0.47 13	
^{154}Tm	−54429	14				∗	8.1	s	0.3	(2^-)	98			α=54 5; β^+=46 5	
^{154}Tm^m	−54360	50	70	50	BD	∗	3.30	s	0.07	(9^+)	98			α=58 5; β^+=42 5	∗
^{154}Yb	−49934	17					409	ms	2	0^+	98			α=92.6 12; β^+=7.4 12	
^{154}Lu	−39570#	200#					1#	s		(2^-)	98			β^+ ?	
^{154}Lu^m	−39510#	200#	58	13	AD		1.12	s	0.08	(9^+)	98	88Vi02	D	$\beta^+\approx$100; β^+p=?; . . .	∗
^{154}Lu^n	−37300#	600#	> 2562				35	μs	3	(17^+)	98			IT=100	
^{154}Hf	−32730#	500#					2	s	1	0^+	98			$\beta^+\approx$100; $\alpha\approx$0	

∗^{154}Tb^m D : . . . ; β^-<0.1 ∗∗
∗^{154}Tb^m E : less than 25 keV, from ENSDF ∗∗
∗^{154}Tm^m D : IT decay has not been observed ∗∗
∗^{154}Lu^m D : . . . ; $\beta^+\alpha$=?; α=0.002# ∗∗
∗^{154}Lu^m D : β^+p and $\beta^+\alpha$ modes observed by 88Vi02; β^+p confirmed by 90Sh.A ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{155}La	−38800#	800#					60#	ms		$5/2^+$#				β^- ?	
^{155}Ce	−48400#	600#					200#	ms	(>300 ns)	$5/2^-$#	97	94Be24	I	β^- ?	
^{155}Pr	−55780#	300#					1#	s	(>300 ns)	$5/2^-$#	97	95Cz.A	I	β^- ?	
^{155}Nd	−62470#	150#					8.9	s	0.2	$3/2^-$#	94			β^-=100	
^{155}Pm	−66970	30					41.5	s	0.2	$(5/2^-)$	94			β^-=100	
^{155}Sm	−70197.2	2.6					22.3	m	0.2	$3/2^-$	94			β^-=100	
^{155}Eu	−71824.5	2.5					4.7611	y	0.0013	$5/2^+$	94			β^-=100	
^{155}Gd	−72077.1	2.5					STABLE			$3/2^-$	97			IS=14.80 12	
^{155}Gd^m	−71956.1	2.5	121.05	0.19			32.0	ms	0.3	$11/2^-$	97			IT=100	
^{155}Tb	−71254	12					5.32	d	0.06	$3/2^+$	94			ε=100	
^{155}Dy	−69160	12					9.9	h	0.2	$3/2^-$	99			β^+=100	
^{155}Dy^m	−68926	12	234.33	0.03			6	μs		$11/2^-$	99			IT=100	
^{155}Ho	−66040	18					48	m	1	$5/2^+$	94			β^+=100	
^{155}Ho^m	−65898	18	141.97	0.11			880	μs	80	$11/2^-$	94			IT=100	
^{155}Er	−62215	7					5.3	m	0.3	$7/2^-$	94			$\beta^+\approx$100; α=0.022 7	
^{155}Tm	−56635	13					21.6	s	0.2	$(11/2^-)$	95			β^+=98.1 3; α=1.9 3	
^{155}Tm^m	−56594	14	41	6			45	s	3	$(1/2^+)$	95			β^+>92; α<8	
^{155}Yb	−50503	17					1.793	s	0.019	$(7/2^-)$	94	96Pa01	T	α=89 4; β^+=11 4	∗
^{155}Lu	−42554	20				&	68.6	ms	1.6	$(11/2^-)$	94	97Da07	TD	α=88 4; β^+ ?	∗
^{155}Lu^m	−42534	21	20	6	AD	&	138	ms	8	$(1/2^+)$	94	97Da07	TJD	α=76 16; β^+ ?	∗
^{155}Lu^n	−40773	20	1781.0	2.0	AD		2.70	ms	0.03	$(25/2^-)$	94	96Pa01	T	$\alpha\approx$100; IT ?	∗
^{155}Hf	−34100#	400#					890	ms	120	$7/2^-$#	94			$\beta^+\approx$100; α ?	
^{155}Ta	−23670#	500#					13	μs	4	$(11/2^-)$	02			p=100	

∗^{155}Yb T : average 96Pa01=1.80(0.02) 91To08=1.75(0.05) ∗∗
∗^{155}Lu T : average 96Pa01=70(1) 97Da07=63(2) 91To09=66(7) 79Ho10=70(6) ∗∗
∗^{155}Lu D : α: average 97Da07=90(2)% 79Ho10=79(4)% with Birge ratio B=4.4 ∗∗
∗^{155}Lu^m T : average 97Da07=150(24) 96Pa01=136(9) 91To09=140(20) ∗∗
∗^{155}Lu^n T : average 96Pa01=2.71(0.03) 81Ho.A=2.62(0.07) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{156}Ce	−45400#	600#				150#	ms		0^+				β^- ?	
^{156}Pr	−51910#	400#				500#	ms	(>300 ns)			95Cz.A	I	β^- ?	
^{156}Nd	−60530	200				5.49	s	0.07	0^+	03			β^-=100	
^{156}Nd^m	−59100	200	1432	5		135	ns		5^-	03			IT=100	
^{156}Pm	−64220	30				26.70	s	0.10	4^-	03			β^-=100	
^{156}Sm	−69370	10				9.4	h	0.2	0^+	03			β^-=100	
^{156}Sm^m	−67972	10	1397.55	0.09		185	ns	7	5^-	03			IT=100	
^{156}Eu	−70093	6				15.19	d	0.08	0^+	03			β^-=100	
^{156}Gd	−72542.2	2.5				STABLE			0^+	03			IS=20.47 9	
^{156}Gd^m	−70404.6	2.5	2137.60	0.05		1.3	μs	0.1	7^-	03			IT=100	
^{156}Tb	−70098	4				5.35	d	0.10	3^-	03			$\beta^+\approx$100; β^- ?	
^{156}Tb^m	−70044	5	54	3		24.4	h	1.0	(7^-)	03			IT=100	∗
^{156}Tb^n	−70010	4	88.4	0.2		5.3	h	0.2	(0^+)	03			IT=?; β^+=?	
^{156}Dy	−70530	7				STABLE		(>1 Ey)	0^+	03	58Ri23	T	IS=0.06 1; α ?; 2β^+ ?	∗
^{156}Ho	−65350	40				56	m	1	4^-	03			β^+=100	
^{156}Ho^m	−65300	40	52.4	0.5		9.5	s	1.5	1^-	03			IT=?; β^+ ?	
^{156}Ho^n	−65250#	60#	100#	50#		7.8	m	0.3	(9^+)	03			β^+=75; IT ?	
^{156}Er	−64213	24				19.5	m	1.0	0^+	03			β^+=100; α=17e–6 4	
^{156}Tm	−56840	16				83.8	s	1.8	2^-	03			$\beta^+\approx$100; α=0.064 10	
^{156}Tm^m	−56636	16	203.6	0.5		400	ns		(11^-)	03			IT=100	
^{156}Tm^n			non existent		RN	19	s	3	9^+	03	91To08	I		∗
^{156}Yb	−53264	11				26.1	s	0.7	0^+	03			β^+=90 2; α=10 2	
^{156}Lu	−43750	70			∗	494	ms	12	$(2)^-$	03			α=?; β^+=5#	
^{156}Lu^m	−43530#	110#	220#	80#	∗	198	ms	2	$(9)^+$	03	96Pa01	D	α=94 6; β^+ ?	∗
^{156}Hf	−37850	210				23	ms	1	0^+	03	96Pa01	D	α=97 3; β^+ ?	∗
^{156}Hf^m	−35890	210	1959.0	1.0	AD	480	μs	40	8^+	03	96Pa01	T	α=100	∗
^{156}Ta	−25800#	400#				144	ms	24	(2^-)	03			p≈100; β^+ ?	
^{156}Ta^m	−25700#	400#	100	8	AD	360	ms	40	(9^+)	03			β^+=95.8 9; p=4.2 9	∗

∗^{156}Tb^m E : derived from E3 24h to 4^+ 49.630 level and E(IT)< B(L)=9 keV ∗∗
∗^{156}Dy T : lower limit is for α decay ∗∗
∗^{156}Tm^n I : see also the discussion in ENSDF’03 ∗∗
∗^{156}Lu^m D : derived from original α=98(9)% ∗∗
∗^{156}Hf D : derived from original α=100(6)% ∗∗
∗^{156}Hf^m T : average 96Pa01=520(10) 81Ho.A=444(17) ∗∗
∗^{156}Ta^m T : 96Pa01=375(54) 93Li34=320(80) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{157}Ce	−40670#	700#				50#	ms		$7/2^+$#				β^- ?	
^{157}Pr	−48970#	400#				300#	ms		$5/2^-$#				β^- ?	
^{157}Nd	−56790#	200#				2#	s	(>300 ns)	$5/2^-$#	97	95Cz.A	I	β^- ?	
^{157}Pm	−62370	110				10.56	s	0.10	$(5/2^-)$	96			β^-=100	
^{157}Sm	−66730	50				8.03	m	0.07	$(3/2^-)$	96			β^-=100	
^{157}Eu	−69467	5				15.18	h	0.03	$5/2^+$	96			β^-=100	
^{157}Gd	−70830.7	2.5				STABLE			$3/2^-$	96			IS=15.65 2	
^{157}Tb	−70770.6	2.5				71	y	7	$3/2^+$	96			ε=100	
^{157}Dy	−69428	7				8.14	h	0.04	$3/2^-$	97			β^+=100	
^{157}Dy^m	−69229	7	199.38	0.07		21.6	ms	1.6	$11/2^-$	97			IT=100	∗
^{157}Ho	−66829	24				12.6	m	0.2	$7/2^-$	96			β^+=100	
^{157}Er	−63420	28				18.65	m	0.10	$3/2^-$	96			β^+=100	
^{157}Er^m	−63265	28	155.4	0.3		76	ms	6	$(9/2^+)$	96			IT=100	
^{157}Tm	−58709	28				3.63	m	0.09	$1/2^+$	97			β^+=100	
^{157}Yb	−53442	10				38.6	s	1.0	$7/2^-$	96			β^+=99.5; α=0.5	
^{157}Lu	−46483	19				6.8	s	1.8	$(1/2^+,3/2^+)$	96			β^+ ?; α=?	∗
^{157}Lu^m	−46462	19	21.0	2.0	AD	4.79	s	0.12	$(11/2^-)$	96			β^+=?; α=6 2	
^{157}Hf	−38750#	200#				115	ms	1	$7/2^-$	96	96Pa01	T	α=86 9; β^+=14 9	
^{157}Ta	−29630	210				10.1	ms	0.4	$1/2^+$	02			α=?; p=3.4 12; . . .	∗
^{157}Ta^m	−29610	210	22	5		4.3	ms	0.1	$11/2^-$	02			α=?; β^+=1#; p=0	
^{157}Ta^n	−28040	210	1593	9	AD	1.7	ms	0.1	$(25/2^-)$	02			α=100	

∗^{157}Dy^m T : as adopted by ENSDF evaluator from 3 inconsistent results ∗∗
∗^{157}Lu T : ENSDF’96 average of very discrepant 91To09=5.7(0.5) 91Le15,92Po14=9.6(8) ∗∗
∗^{157}Ta D : . . . ; β^+=1# ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{158}Pr	−44730#	600#					200#	ms						β^- ?	
^{158}Nd	−54400#	400#					700#	ms	(>300 ns)	0^+	97	95Cz.A	I	β^- ?	
^{158}Pm	−59090	130					4.8	s	0.5		96			β^-=100	
^{158}Sm	−65210	80					5.30	m	0.03	0^+	96			β^-=100	
^{158}Eu	−67210	80					45.9	m	0.2	(1^-)	96			β^-=100	
^{158}Gd	−70696.8	2.5					STABLE			0^+	96			IS=24.84 7	
^{158}Tb	−69477.2	2.6					180	y	11	3^-	96			β^+=83.4 7; β^-=16.6 7	
^{158}Tb^m	−69366.9	2.9	110.3	1.2			10.70	s	0.17	0^-	96			IT≈100; β^-<0.6; . . .	*
^{158}Tb^n	−69088.8	2.6	388.37	0.15			395	μs		7^-					
^{158}Dy	−70412	3					STABLE			0^+	96			IS=0.10 1; α ?; 2β^+ ?	
^{158}Ho	−66191	27					11.3	m	0.4	5^+	97			β^+≈100; α ?	
^{158}Ho^m	−66124	27	67.200	0.010			28	m	2	2^-	97			IT>81; β^+<19	
^{158}Ho^n	−66010#	80#	180#	70#			21.3	m	2.3	(9^+)	97			β^+>93; IT<7#	
^{158}Er	−65304	25					2.29	h	0.06	0^+	96			ε=100	
^{158}Tm	−58703	25				*	3.98	m	0.06	2^-	96			β^+=100	
^{158}Tm^m	−58650#	100#	50#	100#		*	20	ns		(5^+)	96	81Dr07	T	IT ?	*
^{158}Yb	−56015	8					1.49	m	0.13	0^+	96			β^+≈100; α≈0.0021 12	
^{158}Lu	−47214	15					10.6	s	0.3	2^-	96	95Ga.A	J	β^+=99.09 20; . . .	*
^{158}Hf	−42104	18					2.84	s	0.07	0^+	96	96Pa01	TD	β^+=55 3; α=45 3	*
^{158}Ta	−31020#	200#				&	49	ms	8	(2^-)	96	97Da07	TJD	α=96 4; β^+ ?	*
^{158}Ta^m	−30880#	200#	140	12	AD	&	36.0	ms	0.8	(9^+)	96	97Da07	TJE	α=93 6; β^+ ?; IT ?	*
^{158}W	−23700#	500#					1.37	ms	0.17	0^+	96	00Ma95	T	α=100	*
^{158}W^m	−21810#	500#	1889	8	AD		143	μs	19	8^+		00Ma95	T	α=100	*

*^{158}Tb^m D : . . . ; β^+<0.01 **
*^{158}Tm^m I : T≈20 s in 81Dr07 was a typo. Value in Fig. 2 was correct. See 96Dr.A **
*^{158}Lu D : . . . ; α=0.91 20 **
*^{158}Hf T : average 96Pa01=2.85(0.07) 73To02=2.8(0.2) **
*^{158}Ta T : average 97Da07=72(12) 96Pa01=46(4) with Birge ratio B=2 **
*^{158}Ta D : derived from original α≈100(8)% **
*^{158}Ta^m T : average 97Da07=37.7(1.5) 96Pa01=35(1) 79Ho10=36.8(1.6) **
*^{158}W T : average 00Ma95=1.5(0.2) 96Pa01=0.9(+0.4–0.3) **
*^{158}W^m T : average 00Ma95=140(20) 96Pa01=160(50) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{159}Pr	−41450#	700#					100#	ms		5/2$^-$#				β^- ?	
^{159}Nd	−50220#	500#					500#	ms		7/2$^+$#				β^- ?	
^{159}Pm	−56850#	200#					1.47	s	0.15	5/2$^-$#	03			β^-=100	
^{159}Sm	−62210	100					11.37	s	0.15	5/2$^-$	03			β^-=100	
^{159}Eu	−66053	7					18.1	m	0.1	5/2$^+$	03			β^-=100	
^{159}Gd	−68568.5	2.5					18.479	h	0.004	3/2$^-$	03			β^-=100	
^{159}Tb	−69539.0	2.6					STABLE			3/2$^+$	03			IS=100.	
^{159}Dy	−69173.5	2.7					144.4	d	0.2	3/2$^-$	03			ε=100	
^{159}Dy^m	−68820.7	2.7	352.77	0.14			122	μs	3	11/2$^-$	03			IT=100	
^{159}Ho	−67336	4					33.05	m	0.11	7/2$^-$	03			β^+=100	
^{159}Ho^m	−67130	4	205.91	0.05			8.30	s	0.08	1/2$^+$	03			IT=100	
^{159}Er	−64567	4					36	m	1	3/2$^-$	03			β^+=100	
^{159}Er^m	−64384	4	182.602	0.024			337	ns	14	9/2$^+$	03			IT=100	
^{159}Er^n	−64138	4	429.05	0.03			590	ns	60	11/2$^-$	03			IT=100	
^{159}Tm	−60570	28					9.13	m	0.16	5/2$^+$	03			β^+=100	
^{159}Yb	−55843	18					1.72	m	0.10	5/2$^{(-)}$	03	93Al03	T	β^+=100	*
^{159}Lu	−49710	40				*	12.1	s	1.0	1/2$^+$#	03			β^+≈100; α=0.1#	
^{159}Lu^m	−49610#	90#	100#	80#		*	10#	s		11/2$^-$#				β^+ ?; IT ?; α ?	
^{159}Hf	−42854	17					5.20	s	0.10	7/2$^-$#	03	96Pa01	T	β^+=65 7; α=35 7	*
^{159}Ta	−34448	21					1.04	s	0.09	(1/2$^+$)		97Da07	TJ	β^+ ?; α=34 5	*
^{159}Ta^m	−34385	20	64	5	AD		514	ms	9	(11/2$^-$)	03	96Pa01	T	α=55 1; β^+ ?	*
^{159}W	−25230#	400#					8.2	ms	0.7	7/2$^-$#	03	96Pa01	TD	α=82 16; β^+ ?	*

*^{159}Yb T : supersedes 80Al14=1.40(0.20) from same group **
*^{159}Hf J : 7/2$^-$ is not measured in 00Di18, p.7: “a 7/2$^-$ assignment is assumed” **
*^{159}Ta T : average 97Da07=0.83(0.18) 96Pa01=1.10(0.10) **
*^{159}Ta^m T : average 97Da07=500(11) 96Pa01=544(16); other 02Ro17=620(50) **
*^{159}W D : derived from original α=92(23)% **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{160}Nd	−47420#	600#				300#	ms		0^+		85Si25	I	β^- ?	*
^{160}Pm	−53100#	300#				2#	s						β^- ?	
^{160}Sm	−60420#	200#				9.6	s	0.3	0^+	97			β^-=100	
^{160}Eu	−63370#	200#				38	s	4	$1^{(-)}$	97			β^-=100	
^{160}Gd	−67948.6	2.6				STABLE		(>31 Ey)	0^+	97	01Da22	T	IS=21.86 19; 2β^- ?	
^{160}Tb	−67842.9	2.6				72.3	d	0.2	3^-	97			β^-=100	
^{160}Dy	−69678.1	2.5				STABLE			0^+	97			IS=2.34 8	
^{160}Ho	−66388	15				25.6	m	0.3	5^+	97			β^+=100	
^{160}Ho^m	−66328	15	59.98	0.03		5.02	h	0.05	2^-	97			IT=65 3; β^+=35 3	
^{160}Ho^n	−66191	22	197	16		3	s		(9^+)	97	ABBW	E	IT=100	*
^{160}Er	−66058	24				28.58	h	0.09	0^+	97			ε=100	
^{160}Tm	−60300	30				9.4	m	0.3	1^-	97			β^+=100	
^{160}Tm^m	−60230	40	70	20		74.5	s	1.5	$5^{(+\#)}$	97			IT=85 5; β^+=15 5	
^{160}Yb	−58170	17				4.8	m	0.2	0^+	97			β^+=100	
^{160}Lu	−50270	60			*	36.1	s	0.3	2^-#	97			β^+=100; α<1e–4	
^{160}Lu^m	−50270#	120#	0#	100#	*	40	s	1		97			$\beta^+\approx$100; α ?	
^{160}Hf	−45937	12				13.6	s	0.2	0^+	97			β^+=99.3 2; α=0.7 2	
^{160}Ta	−35880	90				1.70	s	0.20	$(2\#)^-$		96Pa01	TJD	β^+ ?; α=?	*
^{160}Ta^m	−35560#	110#	310#	90#		1.55	s	0.04	$(9)^+$	97	96Pa01	TJ	β^+=66#; α=?	*
^{160}W	−29360	210				90	ms	5	0^+	97	96Pa01	TD	α=87 8; β^+ ?	*
^{160}Re	−16660#	400#				860	μs	120	(2^-)	02	92Pa05	J	p=91 5; α=9 5	*

*^{160}Nd I : seen in the thermal fission of ^{252}Cf **
*^{160}Ho^n E : less than 55 keV above 169.55 level, from ENSDF **
*^{160}Ta J : from α correlation with ^{156}Lu line **
*^{160}Ta^m J : from α correlation with ^{156}Lu^m line **
*^{160}W T : average 96Pa01=91(5) 81Ho10=81(15) **
*^{160}Re J : protons from $d_{3/2}$ orbital **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{161}Nd	−42960#	700#				200#	ms		$1/2^-$#				β^- ?	
^{161}Pm	−50430#	500#				700#	ms		$5/2^-$#				β^- ?	
^{161}Sm	−56980#	300#				4.8	s	0.8	$7/2^+$#	00			β^-=100	
^{161}Eu	−61780#	300#				26	s	3	$5/2^+$#	00			β^-=100	
^{161}Gd	−65512.7	2.7				3.646	m	0.003	$5/2^-$	00	94It.A	T	β^-=100	
^{161}Tb	−67468.2	2.6				6.906	d	0.019	$3/2^+$	00			β^-=100	
^{161}Dy	−68061.1	2.5				STABLE			$5/2^+$	00			IS=18.91 24	
^{161}Ho	−67203	3				2.48	h	0.05	$7/2^-$	00			ε=100	
^{161}Ho^m	−66992	3	211.16	0.03		6.76	s	0.07	$1/2^+$	00			IT=100	
^{161}Er	−65209	9				3.21	h	0.03	$3/2^-$	00			β^+=100	
^{161}Er^m	−64813	9	396.44	0.04		7.5	μs	0.7	$11/2^-$	00			IT=100	
^{161}Tm	−61899	28				30.2	m	0.8	$7/2^+$	00			β^+=100	
^{161}Tm^m	−61892	28	7.4	0.2		5#	m		$1/2^+$	00			β^+ ?; IT ?	
^{161}Yb	−57844	16				4.2	m	0.2	$3/2^-$	00			β^+=100	
^{161}Lu	−52562	28				77	s	2	$1/2^+$	00			β^+=100	
^{161}Lu^m	−52400	30	166	18		7.3	ms	0.4	$(9/2^-)$	00	ABBW	E	IT=100	*
^{161}Hf	−46319	23				18.2	s	0.5	$3/2^-$#	00			$\beta^+\approx$100; α<0.13	
^{161}Ta	−38730#	60#			* &	3#	s		$1/2^+$#				β^+ ?; α ?	
^{161}Ta^m	−38684	23	50#	50#	* &	2.89	s	0.12	$11/2^-$#	00			β^+=95#; α=?	
^{161}W	−30410#	200#				409	ms	16	$7/2^-$#	00	96Pa01	T	α=73 3; β^+=27 3	*
^{161}Re	−20880	210				370	μs	40	$1/2^+$	02	97Ir01	D	p=97 2; α ?	*
^{161}Re^m	−20750	210	123.8	1.3		15.6	ms	0.9	$11/2^-$	02			α=?; p=4.8 6	

*^{161}Lu^m E : less than K binding energy (61 keV) above 135.6 level, from ENSDF **
*^{161}W T : average 96Pa01=409(18) 79Ho10=410(40) **
*^{161}Re D : derived from original p=100(7)% **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{162}Pm	−46310#	700#					500#	ms						β^- ?	
^{162}Sm	−54750#	500#					2.4	s	0.5	0^+		00As.A	TD	β^-=100	
^{162}Eu	−58650#	300#					10.6	s	1.0		99			β^-=100	
^{162}Gd	−64287	5					8.4	m	0.2	0^+	99			β^-=100	
^{162}Tb	−65680	40					7.60	m	0.15	1^-	99			β^-=100	
^{162}Dy	−68186.8	2.5					STABLE			0^+	99			IS=25.51 26	
^{162}Ho	−66047	4					15.0	m	1.0	1^+	99			β^+=100	
^{162}Ho^m	−65941	8	106	7			67.0	m	0.7	6^-	99			IT=62; β^+=38	*
^{162}Er	−66343	3					STABLE		(>140 Ty)	0^+	99	56Po16	T	IS=0.14 1; α ?; 2β^+ ?	*
^{162}Tm	−61484	26					21.70	m	0.19	1^-	99			β^+=100	
^{162}Tm^m	−61350	50	130	40			24.3	s	1.7	5^+	99	ABBW	E	IT ?; β^+=18 4	*
^{162}Yb	−59832	16					18.87	m	0.19	0^+	99			β^+=100	
^{162}Lu	−52840	80				*	1.37	m	0.02	$1^{(-)}$	99	98Ge13	J	β^+=100	
^{162}Lu^m	−52720#	220#	120#	200#		*	1.5	m		4^-#	99			$\beta^+\approx$100; IT ?	
^{162}Lu^n	−52540#	220#	300#	200#		*	1.9	m			99			$\beta^+\approx$100; IT ?	
^{162}Hf	−49173	10					39.4	s	0.9	0^+	99			$\beta^+\approx$100; α=0.008 1	
^{162}Ta	−39780	50					3.57	s	0.12	3^+#	99			$\beta^+\approx$100; α=0.074 10	
^{162}W	−34002	18					1.36	s	0.07	0^+	99			β^+ ?; α=45.2 16	
^{162}Re	−22350#	200#					107	ms	13	(2^-)	99			α=94 6; β^+ ?	
^{162}Re^m	−22180#	200#	173	10	AD		77	ms	9	(9^+)	99			α=91 5; β^+ ?	
^{162}Os	−14500#	500#					1.87	ms	0.18	0^+	99	00Ma95	T	α=100	*

*^{162}Ho^m E : about 10 keV above level at 96.1(0.1), from ENSDF; error from NUBASE **

*^{162}Er T : lower limit is for α decay **

*^{162}Tm^m E : above 66.90 level and less than 192 keV, from ENSDF **

*^{162}Os T : average 00Ma95=1.9(0.2) 96Bi07=1.5(+0.7–0.5) 89Ho12=1.9(0.7) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Decay modes and intensities (%)
^{163}Pm	−43150#	800#				200#	ms		$5/2^-$#		β^- ?
^{163}Sm	−50900#	700#				1#	s		$1/2^-$#		β^- ?
^{163}Eu	−56630#	500#				6#	s		$5/2^+$#		β^- ?
^{163}Gd	−61490#	300#				68	s	3	$7/2^+$#	00	β^-=100
^{163}Tb	−64601	5				19.5	m	0.3	$3/2^+$	00	β^-=100
^{163}Dy	−66386.5	2.5				STABLE			$5/2^-$	00	IS=24.90 16
^{163}Ho	−66383.9	2.5				4.570	ky	0.025	$7/2^-$	00	ε=100
^{163}Ho^m	−66086.0	2.5	297.88	0.07		1.09	s	0.03	$1/2^+$	00	IT=100
^{163}Er	−65174	5				75.0	m	0.4	$5/2^-$	00	β^+=100
^{163}Er^m	−64729	5	445.5	0.6		580	ns	100	$(11/2^-)$	00	IT=100
^{163}Tm	−62735	6				1.810	h	0.005	$1/2^+$	00	β^+=100
^{163}Yb	−59304	16				11.05	m	0.25	$3/2^-$	00	β^+=100
^{163}Lu	−54791	28				3.97	m	0.13	$1/2^{(+)}$	01	β^+=100
^{163}Hf	−49286	28				40.0	s	0.6	$3/2^-$#	00	β^+=100; α<0.0001
^{163}Ta	−42540	40				10.6	s	1.8	$1/2^+$#	00	$\beta^+\approx$100; $\alpha\approx$0.2
^{163}W	−34910	50				2.8	s	0.2	$3/2^-$#	00	β^+ ?; α=13 2
^{163}Re	−26007	20				390	ms	70	$(1/2^+)$	00	β^+ ?; α=32 3
^{163}Re^m	−25892	20	115	4	AD	214	ms	5	$(11/2^-)$	00	α=66 4; β^+ ?
^{163}Os	−16120#	400#				5.5	ms	0.6	$7/2^-$#	00	$\alpha\approx$100; β^+ ?; β^+p ?

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{164}Sm	−48180#	800#					500#	ms		0^+				β^- ?	
^{164}Eu	−53100#	600#					2#	s						β^- ?	
^{164}Gd	−59750#	400#					45	s	3	0^+	01			β^-=100	
^{164}Tb	−62080	100					3.0	m	0.1	(5^+)	01			β^-=100	
^{164}Dy	−65973.3	2.5					STABLE			0^+	01			IS=28.18 37	
^{164}Ho	−64987.1	2.8					29	m	1	1^+	01			ε=60 5; β^-=40 5	
^{164}Ho^m	−64847.3	2.8	139.77	0.08			38.0	m	1.0	6^-	01			IT=100	
^{164}Er	−65950	3					STABLE			0^+	01			IS=1.61 3; α ?; 2β^+ ?	
^{164}Tm	−61888	28				*	2.0	m	0.1	1^+	01			ε=61 1; e$^+$=39 1	
^{164}Tm^m	−61878	29	10	6		*	5.1	m	0.1	6^-	01	ABBW	E	IT≈80; β^+≈20	*
^{164}Yb	−61023	16					75.8	m	1.7	0^+	01			ε=100	
^{164}Lu	−54642	28					3.14	m	0.03	$1^{(-)}$	01			β^+=100	*
^{164}Hf	−51822	20					111	s	8	0^+	01			β^+=100	
^{164}Ta	−43283	28					14.2	s	0.3	(3^+)	01			β^+=100	*
^{164}W	−38234	12					6.3	s	0.2	0^+	01			β^+=96.2 12; α=3.8 12	
^{164}Re	−27640#	160#				* &				high		95Pa.A	J	α ?	
^{164}Re^m	−27520	100	120#	120#		* &	530	ms	230	$(2\#)^-$	01	96Pa01	JD	α=?; β^+=42#	*
^{164}Os	−20460	210					21	ms	1	0^+	01			α=?; β^+=2#	
^{164}Ir	−7270#	410#				&	1#	ms		2^-#				p ?; α ?; β^+ ?	
^{164}Ir^m	−7000#	400#	270#	110#		&	94	μs	27	9^+#	02	02Ma61	T	p=?; α ?; β^+ ?	*

*^{164}Tm^m E : less than 20 keV, from ENSDF **
*^{164}Lu J : negative parity proposed by 98Ge13; odd-odd ^{160}Tm ^{162}Tm ^{162}Lu have 1^- ground-state **
*^{164}Ta D : was erroneously considered as alpha emitter, instead of ^{163}Ta by 83Sc18 **
*^{164}Re^m J : from α correlation with ^{160}Ta line **
*^{164}Ir^m T : average 02Ma61=58(+46–18) 01Ke05=110(+60–30) **

^{165}Sm	−43800#	900#					200#	ms		$5/2^-$#			β^- ?
^{165}Eu	−50560#	700#					1#	s		$5/2^+$#			β^- ?
^{165}Gd	−56470#	500#					10.3	s	1.6	$1/2^-$#	99		β^-=100
^{165}Tb	−60660#	200#					2.11	m	0.10	$3/2^+$#	92		β^-=100
^{165}Dy	−63617.9	2.5					2.334	h	0.001	$7/2^+$	92		β^-=100
^{165}Dy^m	−63509.7	2.5	108.160	0.003			1.257	m	0.006	$1/2^-$	92		IT=97.76 11; β^-=2.24 11
^{165}Ho	−64904.6	2.5					STABLE			$7/2^-$	92		IS=100.
^{165}Er	−64528	3					10.36	h	0.04	$5/2^-$	92		ε=100
^{165}Tm	−62936	3					30.06	h	0.03	$1/2^+$	92		β^+=100
^{165}Yb	−60287	28					9.9	m	0.3	$5/2^-$	92		β^+=100
^{165}Lu	−56442	27				*	10.74	m	0.10	$1/2^+$	99		β^+=100
^{165}Hf	−51636	28					76	s	4	$(5/2^-)$	92		β^+=100
^{165}Ta	−45855	17					31.0	s	1.5	$5/2^-$#	92		β^+=100
^{165}Ta^p	−45800	30	60	30	AD					$9/2^-$#			
^{165}W	−38862	25					5.1	s	0.5	$3/2^-$#	99		β^+≈100; α<0.2
^{165}Re	−30657	28				* &	1#	s		$1/2^+$#	99		β^+ ?; α ?
^{165}Re^m	−30610	23	47	26	AD	* &	2.1	s	0.3	$11/2^-$#	99		β^+=87 3; α=13 3
^{165}Os	−21650#	200#					71	ms	3	$(7/2^-)$	99		α>60; β^+<40
^{165}Ir	−11630#	220#					< 1#	μs		$1/2^+$#	02		p ?; α ?
^{165}Ir^m	−11440	210	180#	50#			300	μs	60	$11/2^-$	02		p=87 4; α=13 4

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{166}Eu	−46600#	800#					400#	ms						β^- ?	
^{166}Gd	−54400#	600#					4.8	s	1.0	0^+		00As.A	TD	β^-=100	
^{166}Tb	−57760	100					25.6	s	2.2		97	00As.A	T	β^-=100	*
^{166}Dy	−62590.1	2.6					81.6	h	0.1	0^+	92			β^-=100	
^{166}Ho	−63076.9	2.5					26.83	h	0.02	0^-	92			β^-=100	
^{166}Ho^m	−63070.9	2.5	5.985	0.018			1.20	ky	0.18	$(7)^-$	92			β^-=100	
^{166}Er	−64931.6	2.5					STABLE			0^+	92			IS=33.61 35	
^{166}Tm	−61894	12					7.70	h	0.03	2^+	92			β^+=100	
^{166}Tm^m	−61772	14	122	8			340	ms	25	6^-		96Dr07	TJE	IT=100	*
^{166}Yb	−61588	8					56.7	h	0.1	0^+	92			ε=100	
^{166}Lu	−56021	30					2.65	m	0.10	$6^{(-)}$	92	98Ge13	J	β^+=100	
^{166}Lu^m	−55990	30	34.37	0.05			1.41	m	0.10	$3^{(-)}$	92	98Ge13	J	β^+=58 5; IT=42 5	
^{166}Lu^n	−55980	30	42.9	0.5			2.12	m	0.10	$0^{(-)}$	92	98Ge13	J	β^+>80; IT<20	
^{166}Hf	−53859	28					6.77	m	0.30	0^+	92			β^+=100	
^{166}Ta	−46098	28					34.4	s	0.5	$(2)^+$	92			β^+=100	
^{166}W	−41892	10					19.2	s	0.6	0^+	00			$\beta^+\approx$100; α=0.035 12	
^{166}Re	−31850#	90#				&	2#	s		2^-#				β^+ ?; α ?	
^{166}Re^m	−31700	70	150#	50#		&	2.5	s	0.2	9^+#	92	92Me10	T	β^+ ?; α=5 2	*
^{166}Re^p	−31700#	100#	150#	50#						low					
^{166}Os	−25438	18					216	ms	9	0^+	92	96Pa01	T	α=72 13; β^+=28 13	*
^{166}Ir	−13210#	200#					10.5	ms	2.2	(2^-)	02			α=93 3; p=7 3	
^{166}Ir^m	−13030#	200#	172	6	p		15.1	ms	0.9	(9^+)	02			α=98.2 6; p=1.8 6	
^{166}Pt	−4790#	500#					300	μs	100	0^+	97	96Bi07	TD	α=100	

*^{166}Tb T : supersedes 94Ts.A=21(6) same group **
*^{166}Tm^m E : less than 25 keV above 109.34 level **
*^{166}Re^m T : average 92Me10=2.3(0.2) 84Sc06=2.8(0.3) **
*^{166}Re^m D : α intensity is derived from 2% < α < 8% as discussed in ENSDF **
*^{166}Os T : average 96Pa01=220(7) 91Se01=194(17) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{167}Eu	−43590#	800#					200#	ms		$5/2^+$#				β^- ?	
^{167}Gd	−50700#	600#					3#	s		$5/2^-$#				β^- ?	
^{167}Tb	−55840#	400#					19	s	3	$3/2^+$#	00	99As03	T	β^-=100	
^{167}Dy	−59940	60					6.20	m	0.08	$(1/2^-)$	00			β^-=100	
^{167}Ho	−62287	6					3.1	h	0.1	$7/2^-$	00			β^-=100	
^{167}Ho^m	−62028	6	259.34	0.11			6.0	μs	1.0	$3/2^+$	00			IT=100	
^{167}Er	−63296.7	2.5					STABLE			$7/2^+$	00			IS=22.93 17	
^{167}Er^m	−63088.9	2.5	207.801	0.005			2.269	s	0.006	$1/2^-$	00			IT=100	
^{167}Tm	−62548.3	2.7					9.25	d	0.02	$1/2^+$	00			ε=100	
^{167}Tm^m	−62368.8	2.7	179.480	0.019			1.16	μs	0.06	$(7/2)^+$	00			IT=100	
^{167}Tm^n	−62255.5	2.7	292.820	0.020			0.9	μs	0.1	$7/2^-$	00			IT=100	
^{167}Yb	−60594	5					17.5	m	0.2	$5/2^-$	00			β^+=100	
^{167}Lu	−57500	30			*		51.5	m	1.0	$7/2^+$	00			β^+=100	
^{167}Lu^m	−57500#	40#	0#	30#	*		> 1	m		$1/2^{(-\#)}$	00			IT ?; β^+ ?	
^{167}Hf	−53468	28					2.05	m	0.05	$(5/2)^-$	00			β^+=100	
^{167}Ta	−48351	28					1.33	m	0.07	$(3/2^+)$	00			β^+=100	
^{167}W	−42089	19					19.9	s	0.5	$3/2^-$#	00			β^+=99.96 1; α=0.04 1	*
^{167}Re	−34840#	50#				&	3.4	s	0.4	$9/2^-$#	00			$\alpha\approx$100; β^+ ?	
^{167}Re^m	−34710	40	130#	40#		&	5.9	s	0.3	$1/2^+$#	00			$\beta^+\approx$99; $\alpha\approx$1	
^{167}Os	−26500	70					810	ms	60	$3/2^-$#	00			α=57 8; β^+=43 8	
^{167}Ir	−17079	19					35.2	ms	2.0	$1/2^+$	02			α=48 6; p=32 4; β^+ ?	
^{167}Ir^m	−16903	19	175.3	2.2	p		30.0	ms	0.6	$11/2^-$	02			α=80 10; β^+ ?; . . .	*
^{167}Pt	−6540#	410#					700	μs	200	$7/2^-$#	00			α=100	

*^{167}W J : lowest observed state by 92Th06 is $13/2^+$ **
*^{167}Ir^m D : . . . ; p=0.4 1 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{168}Gd	−48100#	700#					300#	ms		0^+		85Si25	I	β^- ?	*
^{168}Tb	−52500#	500#					8.2	s	1.3	4^-#	99			β^-=100	
^{168}Dy	−58560	140					8.7	m	0.3	0^+	99			β^-=100	
^{168}Ho	−60070	30					2.99	m	0.07	3^+	94			β^-=100	
^{168}Ho^m	−60010	30	59	1			132	s	4	(6^+)	94	90Ch37	E	IT≈100; β^-<0.5	
^{168}Er	−62996.7	2.5					STABLE			0^+	94			IS=26.78 26	
^{168}Tm	−61317.7	2.9					93.1	d	0.2	3^+	94			β^+≈100; β^-=0.010 7	
^{168}Yb	−61575	4					STABLE		(>130 Ty)	0^+	94	56Po16	T	IS=0.13 1; α ?; 2β^+ ?	*
^{168}Lu	−57060	50				*	5.5	m	0.1	$6^{(-)}$	94	98Ge13	J	β^+=100	
^{168}Lu^m	−56880	100	180	110	BD	*	6.7	m	0.4	3^+	94			β^+>95; IT<5	
^{168}Hf	−55361	28					25.95	m	0.20	0^+	01			ε≈98; e^+≈2	
^{168}Ta	−48394	28					2.0	m	0.1	$(2^-,3^+)$	94			β^+=100	
^{168}W	−44890	16					51	s	2	0^+	94			β^+≈100; α=0.0032 10	
^{168}Re	−35790	30					4.4	s	0.1	$(5^+,6^+,7^+)$	94			β^+≈100; α≈0.005	
^{168}Re^m			non existent		RN		6.6	s	1.5			92Me10	I		
^{168}Os	−29991	12					2.06	s	0.06	0^+	94	96Pa01	T	β^+=51 3; α=49 3	*
^{168}Ir	−18740#	150#				*	161	ms	21	high	94	96Pa01	TJD	α=82 14	
^{168}Ir^m	−18690	110	50#	100#		*	125	ms	40	low	94	96Pa01	TJ	α=?; β^+ ?	
^{168}Pt	−11040	210					2.00	ms	0.18	0^+	94	98Ki20	T	α≈100; β^+=0.7#	*

*^{168}Gd I : seen in the thermal fission of ^{252}Cf **
*^{168}Yb T : lower limit is for α decay **
*^{168}Os T : average 96Pa01=2.1(0.1) 84Sc06=2.0(0.2) 82En03=2.2(0.1) 78Ca11=1.9(0.1) **
*^{168}Os T : 84Sc06 supersedes 78Sc26=2.4(0.2) from same group **
*^{168}Pt T : average 98Ki20=2.0(0.2) 96Bi07=2.0(0.4) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{169}Gd	−43900#	800#					1#	s		$7/2^-$#				β^- ?	
^{169}Tb	−50100#	600#					2#	s		$3/2^+$#				β^- ?	
^{169}Dy	−55600	300					39	s	8	$(5/2^-)$	91			β^-=100	
^{169}Ho	−58803	20					4.7	m	0.1	$7/2^-$	91			β^-=100	
^{169}Er	−60928.7	2.5					9.40	d	0.02	$1/2^-$	91			β^-=100	
^{169}Tm	−61280.0	2.5					STABLE			$1/2^+$	91			IS=100.	
^{169}Yb	−60370	4					32.026	d	0.005	$7/2^+$	91			ε=100	
^{169}Yb^m	−60346	4	24.199	0.003			46	s	2	$1/2^-$	91			IT=100	
^{169}Lu	−58077	5					34.06	h	0.05	$7/2^+$	91			β^+=100	
^{169}Lu^m	−58048	5	29.0	0.5			160	s	10	$1/2^-$	91			IT=100	
^{169}Hf	−54717	28					3.24	m	0.04	$(5/2)^-$	91			β^+=100	
^{169}Ta	−50290	28					4.9	m	0.4	$(5/2^+)$	91	98Zh03	J	β^+=100	
^{169}W	−44918	15					76	s	6	$(5/2^-)$	91			β^+=100	
^{169}Re	−38386	28					8.1	s	0.5	$9/2^-$#	91	92Me10	TD	β^+=?; α=0.005 3	*
^{169}Re^m	−38241	17	145	29	AD		15.1	s	1.6	$1/2^+$#	91	92Me10	TD	β^+ ?; α≈0.2	*
^{169}Os	−30721	25					3.46	s	0.11	$3/2^-$#	91	96Pa01	T	β^+=89 1; α=11 1	*
^{169}Ir	−22081	26				&	780	ms	360	$1/2^+$#		99Po09	TD	α=50 18; β^+ ?	
^{169}Ir^m	−21927	22	154	24	AD	&	308	ms	22	$11/2^-$#	91	96Pa01	TD	α=81 7; β^+=19 7	*
^{169}Pt	−12380#	200#					3.7	ms	1.5	$3/2^-$#	91	96Pa01	T	α=?; β^+=1#	*
^{169}Au	−1790#	300#					150#	μs		$1/2^+$#				α ?; β^+ ?	

*^{169}Re D : α=0.005(3)% derived from original α=0.001% - 0.01% **
*^{169}Re^m T : average 92Me10=16.3(0.8) 84Sc06=12.9(1.1) **
*^{169}Os T : average 96Pa01=3.6(0.2) 95Hi02=3.2(0.3) 84Sc06=3.5(0.2) 82En03=3.4(0.2) **
*^{169}Ir^m T : also 99Po09=323(+90–66) D : average 99Po09=84(8)% 96Pa01=72(13)% **
*^{169}Pt T : average 96Pa01=5(3) 81Ho10=2.5(+2.5–1.0) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{170}Tb	−46340#	700#					3#	s						β^- ?	
^{170}Dy	−53660#	200#					30#	s		0^+	02			β^- ?	
^{170}Ho	−56240	50				*	2.76	m	0.05	6^+#	02			β^-=100	
^{170}Ho^m	−56140	60	100	80	BD	*	43	s	2	(1^+)	02			β^-=100	
^{170}Er	−60114.6	2.8					STABLE		(>320 Py)	0^+	02	96De60	T	IS=14.93 27; . . .	*
^{170}Tm	−59800.6	2.5					128.6	d	0.3	1^-	02			$\beta^-\approx$100; ε=0.131 10	
^{170}Tm^m	−59617.4	2.5	183.197	0.004			4.12	μs	0.13	$(3)^+$	02			IT=100	
^{170}Yb	−60769.0	2.4					STABLE			0^+	02			IS=3.04 15	
^{170}Yb^m	−59510.5	2.4	1258.46	0.14			370	ns	15	4^-	02			IT=100	
^{170}Lu	−57310	17					2.012	d	0.020	0^+	02			β^+=100	
^{170}Lu^m	−57217	17	92.91	0.09			670	ms	100	$(4)^-$	02			IT=100	
^{170}Hf	−56254	28					16.01	h	0.13	0^+	02			ε=100	
^{170}Ta	−50138	28					6.76	m	0.06	$(3)^{(+\#)}$	02			β^+=100	
^{170}W	−47293	15					2.42	m	0.04	0^+	02			$\beta^+\approx$100; α<1#	
^{170}Re	−38918	26					9.2	s	0.2	(5^+)	02			$\beta^+\approx$100; α<0.01#	
^{170}Os	−33928	11					7.46	s	0.23	0^+	02			β^+=?; α=8.6 18	
^{170}Ir	−23320#	100#					910	ms	150	low#	02			β^+ ?; α=5.2 17	
^{170}Ir^m	−23050	70	270#	70#			440	ms	60	high#	02			α=36 10; β^+ ?; IT ?	
^{170}Pt	−16306	19					13.8	ms	0.5	0^+	02			α=?; β^+=2#	
^{170}Au	−3610#	200#					310	μs	50	(2^-)	02			p=85 10; α=15 10	
^{170}Au^m	−3340#	200#	274	16	p		630	μs	60	(9^+)	02	02Ma61	TD	p=75 15; α=?; β^+ ?	*

*^{170}Er D : . . . ; 2β^- ?; α ? **
*^{170}Au^m T : from 02Ke.C=620(+60–50); other 02Ma61=570(+310–150) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{171}Tb	−43500#	800#					500#	ms		$3/2^+$#				β^- ?	
^{171}Dy	−50110#	300#					6#	s		$7/2^-$#				β^- ?	
^{171}Ho	−54520	600					53	s	2	$7/2^-$#	02			β^-=100	
^{171}Er	−57724.9	2.8					7.516	h	0.002	$5/2^-$	02			β^-=100	
^{171}Er^m	−57526.3	2.8	198.6	0.1			210	ns	10	$1/2^-$	02			IT=100	
^{171}Tm	−59215.6	2.6					1.92	y	0.01	$1/2^+$	02			β^-=100	
^{171}Tm^m	−58790.6	2.6	424.9560	0.0015			2.60	μs	0.02	$7/2^-$	02			IT=100	
^{171}Yb	−59312.1	2.4					STABLE			$1/2^-$	02			IS=14.28 57	
^{171}Yb^m	−59216.8	2.4	95.282	0.002			5.25	ms	0.24	$7/2^+$	02			IT=100	
^{171}Yb^n	−59189.7	2.4	122.416	0.002			265	ns	20	$5/2^-$	02			IT=100	
^{171}Lu	−57833.5	2.8					8.24	d	0.03	$7/2^+$	02			β^+=100	
^{171}Lu^m	−57762.4	2.8	71.13	0.08			79	s	2	$1/2^-$	02			IT=100	
^{171}Hf	−55431	29					12.1	h	0.4	$7/2^{(+)}$	02			β^+=100	
^{171}Hf^m	−55409	29	21.93	0.09			29.5	s	0.9	$1/2^{(-)}$	02			IT$\approx$100; β^+ ?	
^{171}Ta	−51720	28					23.3	m	0.3	$(5/2^-)$	02			β^+=100	
^{171}W	−47086	28					2.38	m	0.04	$(5/2^-)$	02			β^+=100	
^{171}Re	−41250	28					15.2	s	0.4	$(9/2^-)$	02			β^+=100	
^{171}Os	−34293	19					8.3	s	0.2	$(5/2^-)$	02			β^+ ?; α=1.80 21	
^{171}Ir	−26430	40					3.6	s	1.0	$1/2^+$#	02			$\alpha\approx$100; β^+ ?	
^{171}Ir^m	−26250#	50#	180#	30#			1.40	s	0.10	$(11/2^-)$	02	99Ba84	J	α=58 11; β^+ ?; p ?	
^{171}Pt	−17470	90					44	ms	7	$3/2^-$#	02			α=?; β^+=2#	
^{171}Au	−7565	26					30	μs	5	$(1/2^+)$	02	03Ba20	T	p$\approx$100; α ?	*
^{171}Au^m	−7315	20	250	16	p		1.014	ms	0.019	$11/2^-$	02	03Ba20	TJ	α=54 4; p=46 4	
^{171}Hg	3500#	300#					80	μs	30	$3/2^-$#	02			$\alpha\approx$100; β^+=0.01#	

*^{171}Au T : average 03Ba20=37(+7–5) 99Po09=17(+9–5); Birge ratio B=2.0 **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{172}Dy	−47730#	400#					3#	s		0^+				β^- ?	
^{172}Ho	−51400#	400#					25	s	3		95			β^-=100	
^{172}Er	−56489	5					49.3	h	0.3	0^+	95			β^-=100	
^{172}Tm	−57380	6					63.6	h	0.2	2^-	95			β^-=100	
^{172}Yb	−59260.3	2.4					STABLE			0^+	95			IS=21.83 67	
^{172}Lu	−56741.3	3.0					6.70	d	0.03	4^-	95			β^+=100	
^{172}Lu^m	−56699	3	41.86	0.04			3.7	m	0.5	1^-	95			IT=100	
^{172}Lu^n	−56632	3	109.41	0.10			440	μs	12	$(1)^+$					
^{172}Hf	−56404	24					1.87	y	0.03	0^+	95			ε=100	
^{172}Hf^m	−54398	24	2005.58	0.11			163	ns	3	(8^-)					
^{172}Ta	−51330	28					36.8	m	0.3	(3^+)	95			β^+=100	
^{172}W	−49097	28					6.6	m	0.9	0^+	95			β^+=100	
^{172}Re	−41520	50				*	15	s	3	(5)	95			β^+=100	
^{172}Re^m	−41520#	110#	0#	100#		*	55	s	5	(2)	95			β^+=100	
^{172}Os	−37238	15					19.2	s	0.9	0^+	95	95Hi02	D	β^+=?; α=1.1 2	
^{172}Ir	−27520#	110#					4.4	s	0.3	(3^+)	95			β^+=98; α=2	
^{172}Ir^m	−27240	30	280#	100#	AD		2.0	s	0.1	(7^+)	95			β^+=77 3; α=23 3	
^{172}Pt	−21101	13					98.4	ms	2.4	0^+	95	02Ro17	T	α=77 21; β^+ ?	*
^{172}Au	−9280#	160#					4.7	ms	1.1	high	95	96Pa01	TJ	α=?; p<2	*
^{172}Hg	−1090	210					420	μs	240	0^+		99Se14	TD	α=100	

*^{172}Pt T : average 02Ro17=104(7) 96Pa01=96(3) 82En03=90(10) 81De22=120(10) and **
*^{172}Pt T : 75Ga25=100(10) D : derived from original α=94(32)% **
*^{172}Au T : average 96Pa01=6.3(1.5) 93Se09=4(1) **
*^{172}Au J : from α correlation with ^{168}Ir line **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{173}Dy	−43780#	500#					2#	s		$9/2^+$#				β^- ?	
^{173}Ho	−49100#	400#					10#	s		$7/2^-$#				β^- ?	
^{173}Er	−53650#	200#					1.434	m	0.017	$(7/2^-)$	95	94It.A	T	β^-=100	
^{173}Tm	−56259	5					8.24	h	0.08	$(1/2^+)$	95			β^-=100	
^{173}Tm^m	−55941	5	317.73	0.20			10	μs		$(7/2^-)$					
^{173}Yb	−57556.3	2.4					STABLE			$5/2^-$	95			IS=16.13 27	
^{173}Yb^m	−57157.4	2.5	398.9	0.5			2.9	μs	0.1	$1/2^-$					
^{173}Lu	−56885.8	2.4					1.37	y	0.01	$7/2^+$	95			ε=100	
^{173}Lu^m	−56762.1	2.4	123.672	0.013			74.2	μs		$5/2^-$					
^{173}Hf	−55412	28					23.6	h	0.1	$1/2^-$	95			β^+=100	
^{173}Ta	−52397	28					3.14	h	0.13	$5/2^-$	95			β^+=100	
^{173}W	−48727	28					7.6	m	0.2	$5/2^-$	95			β^+=100	
^{173}Re	−43554	28					2.0	m	0.3	$(5/2^-)$	95			β^+=100	
^{173}Os	−37438	15					22.4	s	0.9	$(5/2^-)$	95	95Hi02	TD	$\beta^+\approx$100; α=0.4 2	
^{173}Ir	−30272	14					9.0	s	0.8	$(3/2^+,5/2^+)$	95			β^+>93; α<7	
^{173}Ir^m	−30019	28	253	27	AD		2.20	s	0.05	$(11/2^-)$	95			β^+=88 1; α=12 1	
^{173}Pt	−21940	60					365	ms	7	$5/2^-$#	95	02Ro17	T	α=84 6; β^+=16 6	*
^{173}Au	−12820	26					25	ms	1	$(1/2^+)$	03			α=86 13; β^+=6#	*
^{173}Au^m	−12606	22	214	23	AD		14.0	ms	0.9	$(11/2^-)$	03			α=89 11; β^+=4#	
^{173}Hg	−2570#	210#					1.1	ms	0.4	$3/2^-$#	03			α=100	

*^{173}Pt T : average 02Ro17=370(13) 96Pa01=376(11) 82En03=360(20) and 81De22=325(20) **
*^{173}Au D : from 94(+6–19)%; and for isomer ^{173}Au^m 92(+8–13)% **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{174}Ho	−45500#	500#				8#	s						β^- ?	
^{174}Er	−51950#	300#				3.2	m	0.2	0^+	99			β^-=100	
^{174}Tm	−53870	40				5.4	m	0.1	$(4)^-$	99			β^-=100	
^{174}Yb	−56949.6	2.4				STABLE			0^+	99			IS=31.83 92	
^{174}Lu	−55575.3	2.4				3.31	y	0.05	1^-	99	98Ge13	J	β^+=100	
^{174}Lu^m	−55404.5	2.4	170.83	0.05		142	d	2	6^-	99	98Ge13	J	IT=99.38 2; ε=0.62 2	
^{174}Hf	−55846.6	2.8				2.0	Py	0.4	0^+	99			IS=0.16 1; α=100; 2β^+ ?	
^{174}Hf^m	−54049	3	1797.5	2.0		2.39	μs	0.04	(8^-)	99			IT=100	
^{174}Ta	−51741	28				1.14	h	0.08	3^+	99			β^+=100	
^{174}W	−50227	28				33.2	m	2.1	0^+	99			β^+=100	
^{174}Re	−43673	28				2.40	m	0.04		99			β^+=100	
^{174}Os	−39996	11				44	s	4	0^+	99			$\beta^+\approx$100; α=0.024 7	
^{174}Ir	−30869	28				7.9	s	0.6	(3^+)	99			β^+=99.5 3; α=0.5 3	
^{174}Ir^m	−30676	26	193	11	AD	4.9	s	0.3	(7^+)	99			β^+=97.5 3; α=2.5 3	
^{174}Pt	−25319	12				889	ms	17	0^+	99			α=76 8; β^+ ?	
^{174}Au	−14200#	100#				139	ms	3	low	99	02Ro17	TD	α=90 6; β^+ ?	*
^{174}Au^m	−13840	70	360#	70#		171	ms	29	high		96Pa01	TJ	α=?; β^+ ?	
^{174}Hg	−6647	20				2.0	ms	0.4	0^+	99	99Se14	T	$\alpha\approx$100; β^+=0.4#	

*^{174}Au T : others 96Pa01=171(29) 83Sc24=120(20) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{175}Ho	−42800#	600#				5#	s		$7/2^-$#				β^- ?	
^{175}Er	−48650#	400#				1.2	m	0.3	$(9/2^+)$	98	96Zh03	TD	β^-=100	
^{175}Tm	−52320	50				15.2	m	0.5	$1/2^+$	98			β^-=100	
^{175}Yb	−54700.6	2.4				4.185	d	0.001	$7/2^-$	93			β^-=100	
^{175}Yb^m	−54185.7	2.4	514.869	0.007		68.2	ms	0.3	$1/2^-$	93			IT=100	
^{175}Lu	−55170.7	2.2				STABLE			$7/2^+$	93			IS=97.41 2	
^{175}Lu^m	−53780	4	1391	3		930	μs	80	$19/2^+$		98Wh02	ETJ	IT=100	
^{175}Hf	−54483.8	2.8				70	d	2	$5/2^-$	93			ε=100	
^{175}Ta	−52409	28				10.5	h	0.2	$7/2^+$	93			β^+=100	
^{175}W	−49633	28				35.2	m	0.6	$(1/2^-)$	93			β^+=100	
^{175}Re	−45288	28				5.89	m	0.05	$(5/2^-)$	93			β^+=100	
^{175}Os	−40105	14				1.4	m	0.1	$(5/2^-)$	93			β^+=100	
^{175}Ir	−33429	20				9	s	2	$(5/2^-)$	93			β^+=99.15 28; α=0.85 28	
^{175}Ir^p	−33357	17	72	17	AD				*am*					
^{175}Pt	−25690	19				2.52	s	0.08	$5/2^-$#	93			α=64 5; β^+ ?	
^{175}Au	−17440	40			&	100#	ms		$1/2^+$#		02Ro17	D	α=?; β^+ ?	*
^{175}Au^m	−17240#	50#	200#	30#	&	156	ms	3	$11/2^-$#	93	02Ro17	T	α=82 17; β^+ ?	*
^{175}Hg	−7990	100				10.8	ms	0.4	$5/2^-$#	93	02Ro17	T	α=?; β^+=1#	*

*^{175}Au D : from analysis of data in 02Ro17, we assign the 6412 line to ^{175}Au **
*^{175}Au^m T : average 02Ro17=158(3) 01Ko44=143(8); others 96Pa01=185(30) 83Sc24=200(22) **
*^{175}Hg T : others 97Uu01=13(+6–4) 96Pa01=8(8) outweighed, not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{176}Er	−46500#	400#				20#	s		0^+				β^- ?	
^{176}Tm	−49370	100				1.85	m	0.03	(4^+)	98	94It.A	T	β^-=100	
^{176}Yb	−53494.1	2.6				STABLE		(>160 Py)	0^+	98	96De60	T	IS=12.76 41; ...	*
^{176}Yb^m	−52444.1	2.6	1050.0	0.3		11.4	s	0.3	$(8)^-$	98			IT=?; β^-<10#	
^{176}Lu	−53387.4	2.2				38.5	Gy	0.7	7^-	98	03Gr02	T	IS=2.59 2; β^-=100	*
^{176}Lu^m	−53264.5	2.2	122.855	0.006		3.664	h	0.019	1^-	98			$\beta^-\approx$100; ε=0.095 16	
^{176}Hf	−54577.5	2.2				STABLE			0^+	98			IS=5.26 7	
^{176}Ta	−51370	30				8.09	h	0.05	$(1)^-$	98			β^+=100	
^{176}Ta^m	−51270	30	103.0	1.0		1.1	ms	0.1	$^{(+)}$	98			IT=100	
^{176}Ta^n	−48550	60	2820	50		0.97	ms	0.07	(20^-)	98			IT=100	*

... A-group is continued on next page ...

. . . *A*-group continued . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{176}W	−50642	28				2.5	h	0.1	0^+	98			ε=100	
^{176}Re	−45063	28				5.3	m	0.3	3^+	98			β^+=100	
^{176}Os	−42098	28				3.6	m	0.5	0^+	98			β^+=100	
^{176}Ir	−33861	20				8.3	s	0.6		98			β^+=96.9 6; α=3.1 6	
^{176}Pt	−28928	14				6.33	s	0.15	0^+	98			β^+ ?; α=38 3	
^{176}Au	−18540#	110#				1.08	s	0.17	(5^-)	98	ABBW	J	α=?; β^+=40#	*
^{176}Au^m	−18380	30	150#	100#		860	ms	160	(7^+)		02Ro17	T	α=?; β^+=40#	*
^{176}Hg	−11779	14				20.4	ms	1.5	0^+	98	02Ro17	T	α=90 9; β^+ ?	*
^{176}Tl	550#	200#				10#	ms						α ?	

*^{176}Yb D : . . . ; 2β^- ?; α ? **
*^{176}Lu T : arithmetic average 03Gr02=40.8(0.3) 98Ni07=36.9(0.2) 92Da03=37.3(0.5) **
*^{176}Lu T : 90Ge05=40.5(0.9) 83Sa44=37.8(0.2) 82Sg01=35.9(0.5) 80No01=40.8(2.4) **
*^{176}Lu T : 72Ko50=37.9(0.3) (a weighed average would yield Birge ratio *B*=4.6) **
*^{176}Ta^n E : 2774.8(1.5) + x, and x estimated 50(50) by NUBASE **
*^{176}Au J : from α decay to ^{172}Ir 168.4 level **
*^{176}Au^m J : from α decay to ^{172}Ir^m **
*^{176}Hg T : average 02Ro17=20(2) 99He25=21(3) 99Po09=21(4); others not used **
*^{176}Hg T : 96Pa01=18(10) and 83Sc24=34(+18–9) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{177}Er	−42800#	500#				3#	s		$1/2^-$#				β^- ?	
^{177}Tm	−47470#	300#				90	s	6	$(7/2^-)$	03			β^-=100	
^{177}Yb	−50989.2	2.6				1.911	h	0.003	$(9/2^+)$	03			β^-=100	
^{177}Yb^m	−50657.7	2.6	331.5	0.3		6.41	s	0.02	$(1/2^-)$	03			IT=100	
^{177}Lu	−52389.0	2.2				6.647	d	0.004	$7/2^+$	03			β^-=100	
^{177}Lu^m	−51418.8	2.2	970.1750	0.0024		160.44	d	0.06	$23/2^-$	03			β^-=78.6 8; IT=21.4 8	
^{177}Lu^n	−48489	10	3900	10		7	m	2	$39/2^-$	03	03Al.1	ET	β^-=?; IT ?	
^{177}Lu^p	−52238.6	2.2	150.3967	0.0010		130	ns	3	$9/2^-$	03			IT=100	
^{177}Lu^q	−51819.3	2.2	569.7068	0.0016		155	μs	7	$1/2^+$	03			IT=100	
^{177}Hf	−52889.6	2.1				STABLE			$7/2^-$	03			IS=18.60 9	
^{177}Hf^m	−51574.1	2.1	1315.4504	0.0008		1.09	s	0.05	$23/2^+$	03			IT=100	
^{177}Hf^n	−50149.6	2.1	2740.02	0.15		51.4	m	0.5	$37/2^-$	03			IT=100	
^{177}Hf^p	−51547.2	2.1	1342.38	0.20		55.9	μs	1.2	$(19/2^-)$	03			IT=100	
^{177}Ta	−51724	4				56.56	h	0.06	$7/2^+$	03			β^+=100	
^{177}Ta^m	−51538	4	186.15	0.06		3.62	μs	0.10	$5/2^-$	03			IT=100	
^{177}Ta^n	−50369	4	1355.01	0.19		5.31	μs	0.25	$21/2^-$	03			IT=100	
^{177}Ta^p	−51651	4	73.36	0.15		410	ns	7	$9/2^-$	03			IT=100	
^{177}Ta^q	−47068	4	4656.3	0.5		133	μs	4	$49/2^-$	03			IT=100	
^{177}W	−49702	28				132	m	2	$1/2^-$	03			β^+=100	
^{177}Re	−46269	28				14	m	1	$5/2^-$	03			β^+=100	
^{177}Re^m	−46184	28	84.71	0.10		50	μs	10	$5/2^+$	03			IT=100	
^{177}Os	−41950	16				3.0	m	0.2	$1/2^-$	03			β^+=100	
^{177}Ir	−36047	20				30	s	2	$5/2^-$	03			$\beta^+\approx$100; α=0.06 1	
^{177}Pt	−29370	15				10.6	s	0.4	$5/2^-$	03			β^+=94.3 5; α=5.7 5	
^{177}Pt^m	−29223	15	147.4	0.4		2.2	μs	0.3	$1/2^-$	03			IT=100	
^{177}Au	−21550	13				1.46	s	0.03	$(1/2^+,3/2^+)$	03	01Ko44	TJD	$\alpha\approx$100; β^+ ?	
^{177}Au^m	−21334	28	216	26		1.180	s	0.012	$11/2^-$	03	01Ko44	ETJ	$\alpha\approx$100; β^+ ?	*
^{177}Au^n	−21093	28	457	26		7	ns	4	$(9/2^-)$	03	02Ro17	ETJ	IT=100	*
^{177}Hg	−12780	80				127.3	ms	1.8	$5/2^-$#	03			α=85; β^+=15	
^{177}Tl	−3328	25				18	ms	5	$(1/2^+)$	03			α=73 13; p=27 13	
^{177}Tl^m	−2521	17	807	18	p	230	μs	40	$(11/2^-)$	03			p=51 8; α=49 8	

*^{177}Au^m E : 157.9 keV above $5/2^+$ level at estimated 44(28) keV by NUBASE **
*^{177}Au^n E : 240.8 keV above $11/2^-$ level T : < 15 ns **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{178}Tm	−44120#	400#					30#	s						β^- ?	
^{178}Yb	−49698	10					74	m	3	0^+	94			β^-=100	
^{178}Lu	−50343.0	2.9					28.4	m	0.2	$1^{(+)}$	94			β^-=100	
^{178}Lu^m	−50219	4	123.8	2.6	RQ		23.1	m	0.3	$9^{(-)}$	94	98Ge13	J	β^-=100	
^{178}Hf	−52444.3	2.1					STABLE			0^+	94			IS=27.28 7	
^{178}Hf^m	−51296.9	2.1	1147.423	0.005			4.0	s	0.2	8^-	94			IT=100	
^{178}Hf^n	−49998.6	2.1	2445.69	0.11			31	y	1	16^+	94	94Ki.A	E	IT=100	
^{178}Hf^p	−49870.8	2.2	2573.5	0.5			68	μs	2	(14^-)	94			IT=100	
^{178}Ta	−50507	15				*	9.31	m	0.03	1^+	94			β^+=100	
^{178}Ta^m	−50410#	50#	100#	50#		*	2.36	h	0.08	$(7)^-$	94			β^+=100	
^{178}Ta^n	−48940#	50#	1570#	50#			59	ms	3	(15^-)	94	96Ko13	T	IT=100	*
^{178}Ta^p	−47510#	50#	3000#	50#			290	ms	12	(21^-)		96Ko13	TJE		*
^{178}W	−50416	15					21.6	d	0.3	0^+	94			ε=100	
^{178}Re	−45653	28					13.2	m	0.2	(3^+)	94			β^+=100	
^{178}Os	−43546	16					5.0	m	0.4	0^+	94			β^+=100	
^{178}Ir	−36252	20					12	s	2		95			β^+=100	
^{178}Pt	−31998	11					21.1	s	0.6	0^+	94			β^+=92.3 3; α=7.7 3	
^{178}Au	−22330	60					2.6	s	0.5		94			$\beta^+\leq$60; $\alpha>$40	
^{178}Hg	−16317	13					269	ms	3	0^+	94	02Ro17	T	α=?; β^+=30#	*
^{178}Tl	−4750#	110#					255	ms	10			02Ro17	TD	α=?; β^+=47#	
^{178}Pb	3568	24					230	μs	150	0^+		01Ro.B	T	$\alpha\approx$100; β^+ ?	*

*^{178}Ta^n E : 1470.6 keV above ^{178}Ta^m, from ENSDF **
*^{178}Ta^n T : average 96Ko13=58(4) 79Du02=60(5) **
*^{178}Ta^p E : 2902 keV above the $(7)^-$ ^{178}Ta^m isomer **
*^{178}Hg T : others 96Pa01=287(23) 91Se01=250(25) and 79Ha10=260(30) **
*^{178}Pb T : two events at 202 and 147 μs **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{179}Tm	−41600#	500#					20#	s		$1/2^+$#				β^- ?	
^{179}Yb	−46420#	300#					8.0	m	0.4	$(1/2^-)$	94			β^-=100	
^{179}Lu	−49064	5					4.59	h	0.06	$7/2^{(+)}$	94			β^-=100	
^{179}Lu^m	−48472	5	592.4	0.4			3.1	ms	0.9	$1/2^{(+)}$	94			IT=100	
^{179}Hf	−50471.9	2.1					STABLE			$9/2^+$	94			IS=13.62 2	
^{179}Hf^m	−50096.9	2.1	375.0367	0.0025			18.67	s	0.04	$1/2^-$	94			IT=100	
^{179}Hf^n	−49366.1	2.1	1105.84	0.19			25.05	d	0.25	$25/2^-$	94			IT=100	
^{179}Ta	−50366.3	2.2					1.82	y	0.03	$7/2^+$	00			ε=100	
^{179}Ta^m	−49049.0	2.2	1317.3	0.4			9.0	ms	0.2	$(25/2^+)$	00			IT=100	
^{179}Ta^n	−47727.0	2.3	2639.3	0.5			54.1	ms	1.7	$(37/2^+)$	00			IT=100	
^{179}W	−49304	16					37.05	m	0.16	$(7/2)^-$	94			β^+=100	
^{179}W^m	−49082	16	221.926	0.008			6.40	m	0.07	$(1/2)^-$	94			IT$\approx$100; β^+=0.28 3	
^{179}Re	−46586	24					19.5	m	0.1	$(5/2)^+$	95			β^+=100	
^{179}Re^m	−46521	24	65.39	0.09			95	μs	25	$(5/2^-)$					
^{179}Os	−43020	18					6.5	m	0.3	$(1/2^-)$	94			β^+=100	
^{179}Ir	−38077	11					79	s	1	$(5/2)^-$	98			β^+=100	
^{179}Pt	−32264	9					21.2	s	0.4	$1/2^-$	94			$\beta^+\approx$100; α=0.24 3	
^{179}Au	−24952	17					7.1	s	0.3	$5/2^-$#	94			β^+=78.0 9; α=22.0 9	
^{179}Au^p	−24853	18	99	16	AD					$(11/2^-)$					
^{179}Hg	−16922	27					1.09	s	0.04	$5/2^-$#	94	02Ro17	T	$\alpha\approx$53; β^+=?; β^+p$\approx$0.15	*
^{179}Tl	−8300	40					270	ms	30	$(1/2^+)$	01	ABBW	J	α=?; β^+=30#	*
^{179}Tl^m	−7440#	50#	860#	30#			1.60	ms	0.16	$(9/2^-)$	01	02Ro17	T	$\alpha\approx$100; IT ?; β^+ ?	*
^{179}Pb	2000#	200#					3#	ms		$5/2^-$#				α ?	

*^{179}Hg T : average 02Ro17=1.08(0.09) 71Ha03=1.09(0.04) **
*^{179}Tl T : average 02Ro17=415(55) 98To14=230(40) 83Sc24=160(+90–40) **
*^{179}Tl J : from α decay to ^{175}Au^m **
*^{179}Tl^m T : average 02Ro17=1.7(0.2) 98To14=1.8(0.4) 96Pa01=0.7(+6–4) 83Sc24=1.4(0.5) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{180}Yb	−44400#	400#					2.4	m	0.5	0^+	94			β^-=100	
^{180}Lu	−46690	70					5.7	m	0.1	5^+	94	95Me03	J	β^-=100	
^{180}Lu^m	−46680	70	13.9	0.3			1	s		3^-		95Me03	EJT	β^- ?; IT ?	
^{180}Hf	−49788.4	2.1					STABLE			0^+	94			IS=35.08 16	
^{180}Hf^m	−48646.9	2.1	1141.48	0.04			5.5	h	0.1	8^-	94			IT≈100; β^-=0.3 1	
^{180}Ta	−48936.2	2.2					8.152	h	0.006	1^+	94			ε=86 3; β^-=14 3	
^{180}Ta^m	−48860.9	1.8	75.3	1.3	RQ		STABLE		(>1.2 Py)	9^-	94			IS=0.012 2; β^- ?	
^{180}Ta^n	−47485.2	2.4	1451.0	1.0			45	μs	2	15^-		96Dr02	TE		
^{180}W	−49644	4					STABLE		(>700 Py)	0^+	94	03Da05	T	IS=0.12 1; α ?; 2β^+ ?	*
^{180}W^m	−48115	4	1529.04	0.03			5.47	ms	0.09	8^-	94			IT=100	
^{180}Re	−45840	21					2.44	m	0.06	$(1)^-$	94			β^+=100	
^{180}Os	−44359	20					21.5	m	0.4	0^+	94			β^+=100	
^{180}Ir	−37978	22					1.5	m	0.1	$(4,5)^{(+\#)}$	94			β^+=100	
^{180}Pt	−34436	11					52	s	3	0^+	94			β^+≈100; α≈0.3	
^{180}Au	−25596	21					8.1	s	0.3		94			β^+≤98.2; α≥1.8	
^{180}Hg	−20245	14					2.56	s	0.02	0^+	94	93Wa03	T	β^+=52 4; α=48 4	
^{180}Tl	−9400#	120#					1.5	s	0.2		94	98To14	TD	β^+ ?; α=7 3; ...	*
^{180}Pb	−1939	21					5	ms	3	0^+	00	96To08	TD	α=100	

*^{180}W T : lower limit is for α decay, also 03Ce01>270 Py 97Ge15>74 Py **
*^{180}W T : indication in 03Da05 for 1.1(+0.8–0.4) Ey, but important background **
*^{180}W T : 03Da09>80 Py for 2β^- decay **
*^{180}Tl D : ... ; β^+SF≈1.0e–4 **
*^{180}Tl D : α=(2-12)% from 02An.A **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{181}Yb	−40850#	400#					1#	m		$3/2^-$#				β^- ?	
^{181}Lu	−44740#	300#					3.5	m	0.3	$(7/2^+)$	91			β^-=100	
^{181}Hf	−47411.9	2.1					42.39	d	0.06	$1/2^-$	91			β^-=100	
^{181}Hf^m	−46817	4	595	3			80	μs	5	$(9/2^+)$		01Sh36	ETJ	IT=100	
^{181}Hf^n	−46372	10	1040	10			100	μs		$(17/2^+)$		01Sh36	ETJ	IT=100	
^{181}Hf^p	−45674	10	1738	10			1.5	ms	0.5	$(27/2^-)$		01Sh36	ETJ	IT=100	
^{181}Ta	−48441.6	1.8					STABLE			$7/2^+$	92			IS=99.988 2	
^{181}Ta^m	−48435.4	1.8	6.238	0.020			6.05	μs	0.12	$9/2^-$	92			IT=100	
^{181}Ta^n	−46957	3	1485	3			25	μs	2	$21/2^-$		98Wh02	ETJ	IT=100	
^{181}Ta^p	−46212	3	2230	3			210	μs	20	$29/2^-$		98Wh02	ETJ	IT=100	
^{181}W	−48254	5					121.2	d	0.2	$9/2^+$	91			ε=100	
^{181}Re	−46511	13					19.9	h	0.7	$5/2^+$	91			β^+=100	
^{181}Os	−43550	30					105	m	3	$1/2^-$	92			β^+=100	
^{181}Os^m	−43500	30	48.9	0.2			2.7	m	0.1	$(7/2)^-$	92	95Ro09	E	β^+=100	
^{181}Ir	−39472	26					4.90	m	0.15	$(5/2)^-$	93			β^+=100	
^{181}Pt	−34375	15					52.0	s	2.2	$1/2^-$	99	95Bi01	D	β^+≈100; α=0.074 10	
^{181}Au	−27871	20					13.7	s	1.4	$(3/2^-)$	99			β^+=?; α=2.7 5	
^{181}Hg	−20661	15					3.6	s	0.1	$1/2^{(-)}$	99			β^+=69 5; α=31 5; ...	*
^{181}Hg^p	−20460#	40#	210#	40#						$13/2^+$					
^{181}Tl	−12801	9					3.2	s	0.3	$1/2^+$#	91	98To14	TD	α=?; β^+ ?	*
^{181}Tl^m	−11944	29	857	29	AD		1.7	ms	0.4	$9/2^-$#		98To14	TD	β^+ ?; α=?; IT ?	*
^{181}Pb	−3140	90				&	45	ms	20	$5/2^-$#		96To01	T	α=?; β^+=2#	*
^{181}Pb^m			non existent		RN	&				$13/2^+$#	91	96To01	I		*

*^{181}Hg D : ... ; β^+p=0.016 4; $\beta^+\alpha$=11e–6 4 **
*^{181}Tl T : average 98To14=3.2(0.3) 92Bo.D=3.4(0.6) **
*^{181}Tl^m T : average 98To14=1.4(0.5) 84Sc.A=2.7(1.0) **
*^{181}Pb T : supersedes 89To01=50(+40–30) from same group **
*^{181}Pb^m I : proved by 96To01 not to exist **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{182}Lu	−41880#	200#					2.0	m	0.2	(0,1,2)	95			β^-=100	
^{182}Hf	−46059	6					9	My	2	0^+	95			β^-=100	
^{182}Hf^m	−44886	6	1172.88	0.18			61.5	m	1.5	8^-	95			β^-=58 3; IT=42 3	
^{182}Ta	−46433.3	1.8					114.43	d	0.03	3^-	95			β^-=100	
^{182}Ta^m	−46417.0	1.8	16.263	0.003			283	ms	3	5^+	95			IT=100	
^{182}Ta^n	−45913.7	1.8	519.572	0.018			15.84	m	0.10	10^-	95			IT=100	
^{182}W	−48247.5	0.8					Stable		(>170 Ey)	0^+	95	03Da05	T	IS=26.50 16; α ?	*
^{182}Re	−45450	100				*	64.0	h	0.5	7^+	95			β^+=100	
^{182}Re^m	−45388	20	60	100	BD	*	12.7	h	0.2	2^+	95			β^+=100	
^{182}Os	−44609	22					22.10	h	0.25	0^+	95			ε=100	
^{182}Ir	−39052	21					15	m	1	(3^+)	95	95Sa42	J	β^+=100	
^{182}Pt	−36169	16					2.2	m	0.1	0^+	95			$\beta^+\approx$100; α=0.038 2	
^{182}Au	−28301	20					15.5	s	0.4	(2^+)	95	01Ib02	J	$\beta^+\approx$100; α=0.13 5	*
^{182}Hg	−23576	10					10.83	s	0.06	0^+	95	97Ba21	D	β^+=86.2 9; α=13.8 9; ...	*
^{182}Tl	−13350	80				*	2.0	s	0.3	2^-#	95	92Bo.D	T	β^+>96; α<4	
^{182}Tl^m	−13250#	130#	100#	100#		*	2.9	s	0.5	(7^+)		91Bo22	TJ	$\alpha\approx$100; β^+ ?	*
^{182}Tl^p	−12750#	160#	600#	140#						10^-					
^{182}Pb	−6826	14					60	ms	40	0^+	95			α=?; β^+=2#	

*^{182}W T : also 03Ce01>25 Ey 97Ge15>8.3 Ey **
*^{182}Au T : average 95Bi01=14.5(1.3)(for β^+), 15.3(1.0)(for α) and 92Ro21=15.6(0.4) **
*^{182}Hg D : ... ; β^+p<1e–5 **
*^{182}Hg D : α average 97Ba21=13.3(0.5) 80Sc09=15.2(0.8); β^+p is from 71Ho07 **
*^{182}Tl^m T : average 91Bo22=3.1(1.0) 92Bo.D=2.8(0.6) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{183}Lu	−39520#	300#					58	s	4	$(7/2^+)$	91			β^-=100	
^{183}Hf	−43290	30					1.067	h	0.017	$(3/2^-)$	91			β^-=100	
^{183}Ta	−45296.1	1.8					5.1	d	0.1	$7/2^+$	91			β^-=100	
^{183}Ta^m	−45222.9	1.8	73.174	0.012			107	ns	11	$9/2^-$	91			IT=100	
^{183}W	−46367.0	0.8					Stable		(>80 Ey)	$1/2^-$	01	03Da05	T	IS=14.31 4; α ?	*
^{183}W^m	−46057.5	0.8	309.493	0.003			5.2	s	0.3	$11/2^+$	01			IT=100	
^{183}Re	−45811	8					70.0	d	1.4	$5/2^+$	99			ε=100	
^{183}Re^m	−43903	8	1907.6	0.3			1.04	ms	0.04	$(25/2^+)$	99			IT=100	
^{183}Os	−43660	50					13.0	h	0.5	$9/2^+$	91			β^+=100	
^{183}Os^m	−43490	50	170.71	0.05			9.9	h	0.3	$1/2^-$	91			β^+=85 2; IT=15 2	
^{183}Ir	−40197	25					58	m	5	$5/2^-$	91	61Di04	T	$\beta^+\approx$100; α=0.05#	*
^{183}Pt	−35772	16					6.5	m	1.0	$1/2^-$	93	95Bi01	D	$\beta^+\approx$100; α=0.0096 5	
^{183}Pt^m	−35738	16	34.50	0.08			43	s	5	$(7/2)^-$	93			$\beta^+\approx$100; α<4e–4; IT ?	
^{183}Au	−30187	10					42.8	s	1.0	$5/2^-$	99	94Pa37	J	$\beta^+\approx$100; α=0.55 25	
^{183}Au^m	−30114	10	73.3	0.4			> 1	μs		$(1/2)^+$	99			IT=100	
^{183}Au^p	−29956	10	230.6	0.6			< 1	μs		$(11/2)^-$	99			IT=100	
^{183}Hg	−23800	8					9.4	s	0.7	$1/2^-$	01			β^+=88.3 20; α=11.7 20; ...	*
^{183}Hg^m	−23560#	40#	240#	40#	EU		5#	s		$13/2^+$#		01Sc41	I	β^+ ?	*
^{183}Hg^p	−23602	13	198	14	AD					$13/2^+$#					
^{183}Tl	−16587	10					6.9	s	0.7	$1/2^+$#	02			β^+=?; α=2#	
^{183}Tl^m	−15944	16	643	14	AD		60	ms	15	$9/2^-$#	02			$\alpha\approx$1.5; β^+ ?; IT ?	
^{183}Tl^n	−15611	20	976.8	17			1.48	μs	0.10	$(13/2^+)$	02	01Mu26	EJ	IT=100	*
^{183}Pb	−7569	28					535	ms	30	$(3/2^-)$	03			α=?; β^+=10#	
^{183}Pb^m	−7475	28	94	8	AD		415	ms	20	$(13/2^+)$	03			$\alpha\approx$100; β^+ ?	

*^{183}W T : also 03Ce01>13 Ey 97Ge15>1.9 Ey **
*^{183}Ir T : average 61Di04=55(7) 61La05=60(6) **
*^{183}Hg D : ... ; β^+p=2.6e–4 8 **
*^{183}Hg^m I : 2001Sc41= no isomer seen with same characteristics as ^{185}Hg or ^{187}Hg **
*^{183}Hg^m I : no isomer in same odd-N ^{181}Pt and ^{179}Os **
*^{183}Tl^n E : 346.8(0.3) keV above ^{183}Tl^m **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{184}Lu	−36410#	400#				20	s	3	(3^+)	90	95Kr04	TJ	β^-=100	
^{184}Lu^m			non existent		RN	20	s		high		95Kr04	I		
^{184}Hf	−41500	40				4.12	h	0.05	0^+	90			β^-=100	
^{184}Hf^m	−40230	40	1272.4	0.4		48	s	10	8^-		95Kr04	TE	β^-=100	
^{184}Ta	−42841	26				8.7	h	0.1	(5^-)	90			β^-=100	
^{184}W	−45707.3	0.9				STABLE		(>180 Ey)	0^+	90	03Da05	T	IS=30.64 2; α ?	*
^{184}Re	−44227	4				38.0	d	0.5	$3^{(-)}$	90			β^+=100	
^{184}Re^m	−44039	4	188.01	0.04		169	d	8	$8^{(+)}$	90			IT=75.4 11; ε=24.6 11	
^{184}Os	−44256.1	1.3				STABLE		(>56 Ty)	0^+	90			IS=0.02 1; α ?; $2\beta^+$?	*
^{184}Ir	−39611	28				3.09	h	0.03	5^-	90			β^+=100	
^{184}Ir^m	−39385	28	225.65	0.11		470	μs		3^+					
^{184}Pt	−37332	18				17.3	m	0.2	0^+	90	95Bi01	D	$\beta^+\approx$100; α=0.0017 7	
^{184}Pt^m	−35493	18	1839.4	1.6		1.01	ms	0.05	8^-	90			IT=100	
^{184}Au	−30319	22				20.6	s	0.9	5^+	03			$\beta^+\approx$100; α<0.016	
^{184}Au^m	−30251	22	68.46	0.01		47.6	s	1.4	2^+	03	94Ib01	EJ	β^+=?; IT=30 10; α<0.016	
^{184}Au^n	−30091	22	228.40	0.06		69	ns	6	3^-	03			IT=100	
^{184}Hg	−26349	10				30.6	s	0.3	0^+	90			β^+=98.89 6; α=1.11 6	
^{184}Tl	−16890	50			*	9.7	s	0.6	2^-#	90	92Bo.D	T	β^+=97.9 7; α=2.1 7	
^{184}Tl^m	−16790#	110#	100#	100#	*	10#	s		7^+#				β^+ ?; IT ?	
^{184}Tl^n	−16390#	150#	500#	140#		> 20	ns		(10^-)		84Sc.A	T	IT ?	*
^{184}Pb	−11045	14				490	ms	25	0^+	03	02An.A	D	α=80 15; β^+ ?	
^{184}Bi	1050#	130#			*	6.6	ms	1.5	3^+#		02An.A	T	α= ?	
^{184}Bi^m	1200#	160#	150#	100#	*	13	ms	2	10^-#		02An.A	T	α= ?	

*^{184}W T : also 03Ce01>29 Ey 97Ge15>4.0 Ey **
*^{184}Os T : lower limit is for α decay **
*^{184}Tl^n T : alpha decay from ^{188}Bi^m not coincident with X(K) and γ **
*^{184}Tl^n I : identified by 02Sc.A **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{185}Hf	−38360#	200#				3.5	m	0.6	$3/2^-$#	95			β^-=100	
^{185}Ta	−41396	14				49.4	m	1.5	$7/2^+$#	95			β^-=100	
^{185}Ta^m	−40090	30	1308	29		> 1	ms		$(21/2^-)$		99Wh03	TJD	IT=100	*
^{185}W	−43389.7	0.9				75.1	d	0.3	$3/2^-$	95			β^-=100	
^{185}W^m	−43192.3	0.9	197.43	0.05		1.597	m	0.004	$11/2^+$	95	94It.A	T	IT=100	
^{185}Re	−43822.2	1.2				STABLE			$5/2^+$	95			IS=37.40 2	
^{185}Re^m	−41698.2	2.3	2124	2		123	ns	23	$(21/2)$		97Sh37	T	IT=100	
^{185}Os	−42809.4	1.3				93.6	d	0.5	$1/2^-$	95			ε=100	
^{185}Os^m	−42707.1	1.5	102.3	0.7		3.0	μs	0.4	$7/2^-$#	95			IT ?	
^{185}Ir	−40336	28				14.4	h	0.1	$5/2^-$	95			β^+=100	
^{185}Pt	−36680	40				70.9	m	2.4	$(9/2^+)$	95			$\beta^+\approx$100; α=0.0050 20	*
^{185}Pt^m	−36580	40	103.4	0.2		33.0	m	0.8	$(1/2^-)$	95			β^+=?; IT<2	
^{185}Au	−31867	26			*	4.25	m	0.06	$5/2^-$	95			$\beta^+\approx$100; α=0.26 6	
^{185}Au^m	−31770#	100#	100#	100#	*	6.8	m	0.3	$1/2^+$#	95			β^+<100; IT ?	
^{185}Hg	−26176	16				49.1	s	1.0	$1/2^-$	95			β^+=94 1; α=6 1	
^{185}Hg^m	−26072	16	103.8	1.0		21.6	s	1.5	$13/2^+$	95	87Ki.A	E	IT=54 10; β^+=46 10; $\alpha\approx$0.03	*
^{185}Tl	−19760	50				19.5	s	0.5	$1/2^+$#	95			β^+=?; α ?	
^{185}Tl^m	−19300	50	452.8	2.0		1.83	s	0.12	$9/2^-$#	95	77Sc03	E	IT$\approx$100; α=0.10 3; β^+ ?	
^{185}Tl^n	−18760	50	1003.0	2.0		8.3	ns	1.4	$(13/2^+)$		95La08	T		
^{185}Pb	−11541	16			*	6.3	s	0.4	$3/2^-$	95	02An15	TJD	α=50 25; β^+ ?	*
^{185}Pb^m	−11480#	40#	60#	40#	*	4.07	s	0.15	$13/2^+$		02An15	TJD	α=50 25; β^+ ?	*
^{185}Bi	−2210#	50#			* &	2#	ms		$9/2^-$#		96Da06	J	p ?; α ?	*
^{185}Bi^m	−2143	18	70#	50#	* &	49	μs	7	$1/2^+$	02	01Po05	T	p=85 6; α=15 6	*

*^{185}Ta^m E : from 99Wh03 : less than 100 keV above 1258 level J : assuming ground-state=7/2$^+$ **
*^{185}Pt D : if the 4444(10) keV α line is from ground-state; otherwise α=0.0010(4)% from isomer **
*^{185}Hg^m E : ENSDF gives 99.3(0.5) plus "8-keV uncertainty", but missed 87Ki.A work **
*^{185}Pb T : average 02An15=6.3(0.4) 80Sc09=6.1(1.1) **
*^{185}Pb^m T : average 02An15=4.3(0.2) 80Sc09=3.73(0.24) (excluding the 6.1 s activity) **
*^{185}Bi T : estimated from 9/2$^-$ isomers in odd Bi and Tl isotopes **
*^{185}Bi^m T : average 01Po05=50(8) 96Da06=44(16) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{186}Hf	−36430#	300#					2.6	m	1.2	0^+	03			β^-=100	
^{186}Ta	−38610	60					10.5	m	0.3	$(2^-,3^-)$	03			β^-=100	
^{186}W	−42509.5	1.7					STABLE		(>4.1 Ey)	0^+	03	03Da09	T	IS=28.43 19; $2\beta^-$?; α ?	∗
^{186}W^m	−40992.3	1.8	1517.2	0.6			18	μs	1	(7^-)	03			IT=100	
^{186}W^n	−38966.7	2.7	3542.8	2.1			> 3	ms		(16^+)	03			IT=100	∗
^{186}Re	−41930.2	1.2					3.7183	d	0.0011	1^-	03			β^-=92.53 10; ε=7.47 10	
^{186}Re^m	−41781	7	149	7			200	ky	50	(8^+)	03			IT=?; β^-<10	∗
^{186}Os	−42999.5	1.4					2.0	Py	1.1	0^+	03			IS=1.59 3; α=100	
^{186}Ir	−39173	17					16.64	h	0.03	5^+	03			β^+=100	
^{186}Ir^m	−39172	17	0.8	0.4			1.92	h	0.05	2^-	03	91Be25	ET	$\beta^+\approx$75; IT$\approx$25	∗
^{186}Pt	−37864	22					2.08	h	0.05	0^+	03			β^+=100; $\alpha\approx$1.4e–4	
^{186}Au	−31715	21					10.7	m	0.5	3^-	03			β^+=100; α=0.0008 2	
^{186}Au^m	−31487	21	227.77	0.07			110	ns	10	2^+	03			IT=100	
^{186}Au^p			non existent		RN		< 2	m				83Po10	I		
^{186}Hg	−28539	11					1.38	m	0.06	0^+	03			$\beta^+\approx$100; α=0.016 5	
^{186}Hg^m	−26322	11	2217.3	0.4			82	μs	5	(8^-)	03			IT=100	
^{186}Tl	−20190	180				∗ &	40#	s		(2^-)	03	91Va04	I	β^+ ?	∗
^{186}Tl^m	−19874	9	320	180	AD	∗ &	27.5	s	1.0	(7^+)	03			$\beta^+\approx$100; $\alpha\approx$0.006	
^{186}Tl^n	−19501	9	690	180	AD		2.9	s	0.2	(10^-)	03			IT=100	∗
^{186}Pb	−14681	11					4.82	s	0.03	0^+	03			β^+ ?; α=40 8	
^{186}Bi	−3170	80				∗	14.8	ms	0.7	(3^+)	03	02An.A	T	$\alpha\approx$100; β^+ ?	∗
^{186}Bi^m	−2900#	160#	270#	140#		∗	9.8	ms	0.4	(10^-)	03	02An.A	T	$\alpha\approx$100; β^+ ?	

∗^{186}W T : limit is $2\beta^-$ decay; 03Da05>170 Ey 03Ce01>27 Ey 97Ge15>6.5 Ey for α decay ∗∗
∗^{186}W^n T : lower limit is 3 ms; upper limit 30 s ∗∗
∗^{186}Re^m T : uncertainty estimated by ENSDF'89 evaluator ∗∗
∗^{186}Ir^m T : average 91Be25=1.90(0.05) 70Fi.A=2.0(0.1) ∗∗
∗^{186}Ir^m E : E is positive and below 1.5 keV ∗∗
∗^{186}Tl I : identified as decay level from ^{190}Bi in 91Va04 ∗∗
∗^{186}Tl^n E : 374.0(0.2) keV above ^{186}Tl^m ∗∗
∗^{186}Bi T : average 02An.A=14.8(0.8) 97Ba21=15.0(1.7) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{187}Hf	−32980#	400#					30#	s	(>300 ns)	$3/2^-$#		99Be63	I	β^- ?	
^{187}Ta	−36770#	200#					2#	m	(>300 ns)	$7/2^+$#		99Be63	I	β^- ?	
^{187}W	−39904.8	1.7					23.72	h	0.06	$3/2^-$	92			β^-=100	
^{187}Re	−41215.7	1.4					41.2	Gy	0.2	$5/2^+$	91	01Ga01	T	IS=62.60 2; β^-=100; . . .	∗
^{187}Os	−41218.2	1.4					STABLE			$1/2^-$	92			IS=1.96 2	
^{187}Ir	−39716	6					10.5	h	0.3	$3/2^+$	91			β^+=100	
^{187}Ir^m	−39530	6	186.15	0.04			30.3	ms	0.6	$9/2^-$	91			IT=100	
^{187}Pt	−36713	28					2.35	h	0.03	$3/2^-$	91			β^+=100	
^{187}Au	−33005	25					8.4	m	0.3	$1/2^+$	91			$\beta^+\approx$100; α=0.003#	
^{187}Au^m	−32884	25	120.51	0.16			2.3	s	0.1	$9/2^-$	91			IT=100	
^{187}Hg	−28118	14				&	1.9	m	0.3	$3/2^-$	91			β^+=100; α>1.2e–4	
^{187}Hg^m	−28059	20	59	16	MD	&	2.4	m	0.3	$13/2^+$	91			β^+=100; α>2.5e–4	
^{187}Tl	−22444	8					51	s		$(1/2^+)$	99			β^+<100; α ?	
^{187}Tl^m	−22109	8	335	3	AD		15.60	s	0.12	$(9/2^-)$	99			IT=?; β^+ ?; α=0.15 5	
^{187}Pb	−14980	8				∗	15.2	s	0.3	$(3/2^-)$	00			β^+=93 2; α=7 2	
^{187}Pb^m	−14969	11	11	11	AD	∗	18.3	s	0.3	$(13/2^+)$	00			β^+=88 2; α=12 2	
^{187}Bi	−6373	15					32	ms	3	$9/2^-$#	01			α>50; β^+ ?	
^{187}Bi^m	−6272	18	101	20	AD		320	μs	70	$1/2^+$#	01			α>50; β^+ ?	
^{187}Bi^n	−6121	15	252	1			7	μs	5	$(13/2^+)$		02Hu14	ETJ	IT=100	

∗^{187}Re D : . . . ; α<0.0001 ∗∗
∗^{187}Re T : others: 89Li30=42.3(0.7) outweighed and, same group, 86Li11=43.5(1.3) ∗∗

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{188}Hf	−30880#	500#					20#	s	(>300 ns)	0^+	02	99Be63	I	β^- ?	
^{188}Ta	−33810#	200#					20#	s	(>300 ns)		02	99Be63	I	β^- ?	
^{188}W	−38667	3					69.78	d	0.05	0^+	02			β^-=100	
^{188}Re	−39016.1	1.4					17.0040	h	0.0022	1^-	02			β^-=100	
^{188}Re^m	−38844.0	1.4	172.069	0.009			18.59	m	0.04	$(6)^-$	02			IT=100	
^{188}Os	−41136.4	1.4					STABLE			0^+	02			IS=13.24 8	
^{188}Ir	−38328	7					41.5	h	0.5	1^-	02			β^+=100	
^{188}Ir^m	−37360	30	970	30			4.2	ms	0.2	7^+#	02	ABBW	E	IT≈100; β^+ ?	*
^{188}Pt	−37823	5					10.2	d	0.3	0^+	02			ε=100; α=2.6e–5 3	
^{188}Au	−32301	20					8.84	m	0.06	$1^{(-)}$	02			β^+=100	
^{188}Hg	−30202	12					3.25	m	0.15	0^+	02			β^+=100; α=3.7e–5 8	
^{188}Hg^m	−27478	12	2724.3	0.4			134	ns	15	(12^+)	02			IT=100	
^{188}Tl	−22350	30				*	71	s	2	(2^-)	02			β^+=100	
^{188}Tl^m	−22307	10	40	30	MD	*	71	s	1	(7^+)	02			β^+=100	
^{188}Tl^n	−22038	10	310	30	MD		41	ms	4	(9^-)	02			IT≈100; β^+ ?	*
^{188}Pb	−17815	11					25.5	s	0.1	0^+	02			β^+=?; α=9.3 8	
^{188}Pb^m	−15237	11	2578.2	0.7			830	ns	210	(8^-)	02			IT=100	
^{188}Pb^n	−15102	11	2713.0	0.6			94	ns		(11^-)	02			IT=100	
^{188}Pb^p	−15020	50	2800	50			797	ns	21		02			IT=100	*
^{188}Bi	−7200	50				* &	44	ms	3	3^+#	02	97Wa05	T	α=?; β^+ ?	*
^{188}Bi^m	−7000#	150#	210#	140#		* &	220	ms	40	(10^-)	02	97Wa05	T	α=?; β^+ ?	*
^{188}Po	−538	19					430	μs	180	0^+	02			α=?; β^+ ?	

*^{188}Ir^m E : less than 100 keV above 923.5 level, from ENSDF **
*^{188}Tl^n E : 268.8(0.5) keV above ^{188}Tl^m, from 91Va04 **
*^{188}Pb^p E : 2700.5 above unknown level, see ENSDF'02 **
*^{188}Bi T : average 97Wa05=46(7) 84Sc.A=44(3) **
*^{188}Bi^m T : average 97Wa05=218(50) 84Sc.A=210(90) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{189}Ta	−31830#	300#					3#	s	(>300 ns)	$7/2^+$#		99Be63	I	β^- ?	
^{189}W	−35480	200					11.6	m	0.3	$(3/2^-)$	91	97Ya03	T	β^-=100	*
^{189}Re	−37978	8					24.3	h	0.4	$5/2^+$	91			β^-=100	
^{189}Os	−38985.4	1.5					STABLE			$3/2^-$	91			IS=16.15 5	
^{189}Os^m	−38954.6	1.5	30.814	0.018			5.8	h	0.1	$9/2^-$	91			IT=100	
^{189}Ir	−38453	13					13.2	d	0.1	$3/2^+$	91			ε=100	
^{189}Ir^m	−38081	13	372.18	0.04			13.3	ms	0.3	$11/2^-$	91			IT=100	
^{189}Ir^n	−36120	13	2333.3	0.4			3.7	ms	0.2	$(25/2)^+$	91			IT=100	
^{189}Pt	−36483	11					10.87	h	0.12	$3/2^-$	92			β^+=100	
^{189}Pt^m	−36291	11	191.6	0.4			143	μs		$(13/2^+)$					
^{189}Au	−33582	20					28.7	m	0.3	$1/2^+$	92			β^+=100; α<3e–5	
^{189}Au^m	−33335	20	247.23	0.17			4.59	m	0.11	$11/2^-$	92			β^+≈100; IT=?	
^{189}Hg	−29630	30					7.6	m	0.1	$3/2^-$	96			β^+=100; α<3e–5	
^{189}Hg^m	−29549	18	80	30	MD		8.6	m	0.1	$13/2^+$	96	01Sc41	E	β^+=100; α<3e–5	
^{189}Tl	−24602	11					2.3	m	0.2	$(1/2^+)$	99			β^+=100	
^{189}Tl^m	−24319	10	283	6	AD		1.4	m	0.1	$9/2^{(-)}$	99	85Bo46	J	β^+≈100; IT<4	
^{189}Pb	−17880	30				*	51	s	3	$(3/2^-)$	91	ABBW	J	β^+>99; α≈0.4	*
^{189}Pb^m	−17840#	50#	40#	30#		*	1#	m		$(13/2^+)$		ABBW	J	β^+ ?; IT ?	*
^{189}Bi	−10060	50					674	ms	11	$(9/2^-)$	98	95Ba75	J	α>50; β^+<50	*
^{189}Bi^m	−9880	50	181	6	AD		6.6	ms	0.6	$(1/2^+)$	98	95Ba75	TJ	α>50; β^+<50	*
^{189}Bi^n	−9700	50	357	1			880	ns	50	$(13/2^+)$		01An11	ETJ	IT=100	*
^{189}Po	−1415	22					5	ms	1	$3/2^-$#		99An52	TD	α=?; β^+ ?	

*^{189}W T : average 97Ya03=11.7(0.5) 65Ka07=11.5(0.3) **
*^{189}Pb J : from α decay to ^{185}Hg **
*^{189}Pb^m J : from α decay from ^{193}Po^m **
*^{189}Bi T : average 02Hu14=667(13) 97Wa05=728(40) 85Co06=680(30) **
*^{189}Bi^m T : average 97An09=4.8(0.5) 97Wa05=5.2(0.6) 95Ba75=7.0(0.2) **
*^{189}Bi^n T : from 02Hu14; also 01An11>360(120) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{190}Ta	−28660#	400#					300#	ms						β^- ?	
^{190}W	−34300	160					30.0	m	1.5	0^+	03			β^-=100	
^{190}W^m	−31920	160	2381	5			< 3.1	ms		(10^-)	03			IT=100	
^{190}Re	−35570	150					3.1	m	0.3	$(2)^-$	03			β^-=100	
^{190}Re^m	−35360	160	210	60			3.2	h	0.2	(6^-)	03	ABBW	E	β^-=54.4 20; IT ?	*
^{190}Os	−38706.3	1.5					STABLE			0^+	03			IS=26.26 2	
^{190}Os^m	−37000.9	1.5	1705.4	0.2			9.9	m	0.1	$(10)^-$	03			IT=100	
^{190}Ir	−36751.2	1.7					11.78	d	0.10	4^-	03			β^+=100; e^+<0.002	
^{190}Ir^m	−36725.1	1.7	26.1	0.1			1.120	h	0.003	(1^-)	03			IT=100	
^{190}Ir^n	−36374.8	1.7	376.4	0.1			3.087	h	0.012	$(11)^-$	03			β^+=91.4 2; IT=8.6 2	
^{190}Ir^p	−36715.0	1.7	36.154	0.025			> 2	μs		$(4)^+$	03			IT=100	
^{190}Ir^q	−36433.6	1.7	317.56	0.04			90	ns		(5^-)	03			IT=100	
^{190}Pt	−37323	6					650	Gy	30	0^+	03			IS=0.014 1; α=100;...	*
^{190}Au	−32881	16				*	42.8	m	1.0	1^-	03			β^+=100; α<1e–6	
^{190}Au^m	−32680#	150#	200#	150#		*	125	ms	20	11^-#	03			IT≈100; β^+ ?	
^{190}Hg	−31370	16					20.0	m	0.5	0^+	03			ε≈100; e^+<1; . . .	*
^{190}Tl	−24330	50				*	2.6	m	0.3	$2^{(-)}$	03			β^+=100	
^{190}Tl^m	−24200#	70#	130#	90#		*	3.7	m	0.3	$7^{(+\#)}$	03			β^+=100	
^{190}Tl^n	−24040#	90#	290#	70#			750	μs	40	(8^-)	03			IT=100	*
^{190}Tl^p	−23920#	90#	410#	70#			> 1	μs		9^-	03	91Va04	ET	IT ?	*
^{190}Pb	−20417	12					71	s	1	0^+	03			β^+ ?; α=0.40 4	
^{190}Pb^m	−17802	12	2614.8	0.8			150	ns		$(10)^+$	03			IT=100	
^{190}Pb^n	−17799	23	2618	20			25	μs		(12^+)	03			IT ?	*
^{190}Pb^p	−17759	12	2658.2	0.8			7.2	μs	0.6	$(11)^-$	03			IT=100	
^{190}Bi	−10900	180					6.3	s	0.1	(3^+)	03	91Va04	J	α=77 21; β^+=?	
^{190}Bi^m	−10483	10	420	180	MD		6.2	s	0.1	(10^-)	03	91Va04	J	α=70 9; β^+ ?	
^{190}Bi^n	−10210	10	690	180	MD		> 500	ns	100	7^+#	03	01An11	ET	IT=100	*
^{190}Po	−4563	13					2.46	ms	0.05	0^+	03			α≈100; β^+=0.1#	

*^{190}Re^m E : from lower limit 119.12 and calculated 173 and 220 (see ENSDF'90) **
*^{190}Re^m E : 210(290) from difference in beta-decay **
*^{190}Pt D : . . . ; 2β^+ ? **
*^{190}Hg D : . . . ; α<3.4e–7 **
*^{190}Tl^n E : 161.9 keV above ^{190}Tl^m **
*^{190}Tl^p E : 236.2 keV above ^{190}Tl^m **
*^{190}Pb^n E : above ^{190}Pb^m, see ENSDF'03 **
*^{190}Bi^n E : 273(1) keV above the (10^-) isomer **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{191}W	−31110#	200#					20#	s	(>300 ns)	$3/2^-$#		99Be63	I	β^- ?	
^{191}Re	−34349	10					9.8	m	0.5	$(3/2^+,1/2^+)$	95			β^-=100	
^{191}Os	−36393.7	1.5					15.4	d	0.1	$9/2^-$	95			β^-=100	
^{191}Os^m	−36319.3	1.5	74.382	0.003			13.10	h	0.05	$3/2^-$	95			IT=100	
^{191}Ir	−36706.4	1.7					STABLE			$3/2^+$	95			IS=37.3 2	
^{191}Ir^m	−36535.2	1.7	171.24	0.05			4.94	s	0.03	$11/2^-$	95			IT=100	
^{191}Ir^n	−34590	40	2120	40			5.5	s	0.7		95	ABBW	E	IT=100	*
^{191}Pt	−35698	4					2.802	d	0.025	$3/2^-$	96			ε=100	
^{191}Pt^m	−35549	4	149.04	0.02			95	μs		$13/2^+$					
^{191}Au	−33810	40					3.18	h	0.08	$3/2^+$	99			β^+=100	
^{191}Au^m	−33540	40	266.2	0.5			920	ms	110	$(11/2^-)$	99			IT=100	
^{191}Hg	−30593	23					49	m	10	$3/2^{(-)}$	00	86Ul02	J	β^+=100; α<5e–6	
^{191}Hg^m	−30470	30	128	22			50.8	m	1.5	$13/2^+$	00	01Sc41	E	β^+=100; α<5e–6	*
^{191}Tl	−26281	8					20#	m		$(1/2^+)$	95			β^+ ?	
^{191}Tl^m	−25984	7	297	7	BD		5.22	m	0.16	$9/2^{(-)}$	95			β^+=100	
^{191}Pb	−20250	40				*	1.33	m	0.08	$(3/2^-)$	95			β^+≈100; α=0.013 5	
^{191}Pb^m	−20231	28	20	50	MD	*	2.18	m	0.08	$13/2^{(+)}$	95	88Me.A	J	β^+≈100; α≈0.02	
^{191}Bi	−13240	7					12.3	s	0.3	$(9/2^-)$	00	03Ke04	T	α=60 20; β^+=40 20	*
^{191}Bi^m	−13000	9	240	4	AD		124	ms	5	$(1/2^+)$	00	03Ke04	T	α=75 25; β^+≈25	*
^{191}Po	−5054	11					22	ms	1	$3/2^-$#	00			α≈100; β^+ ?	
^{191}Po^m	−5020	10	34	12	AD		98	ms	8	$(13/2^+)$	00			α≈100; β^+ ?	

*^{191}Ir^n E : estimated less than 150 keV above 2047.1 level, from ENSDF **
*^{191}Hg^m E : original error (8 keV) increased by 20 for isomer+ground-state lines in trap **
*^{191}Bi T : average 03Ke04=12.4(0.4) 85Co06=12(1) 74Le02=13(1) 72Ga27=12.0(0.7) **
*^{191}Bi^m T : average 03Ke04=121(+8–5) 99An36=115(10) 81Le23=150(15) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{192}W	−29650#	600#				10#	s	(>300 ns)	0^+		99Be63	I	β^- ?	
^{192}Re	−31710#	200#				16	s	1		98			β^-=100	
^{192}Os	−35880.5	2.6				STABLE		(>9.8 Ty)	0^+	98			IS=40.78 19; 2β^- ?; α ?	*
^{192}Os^m	−33865.1	2.6	2015.40	0.11		5.9	s	0.1	(10^-)	98			IT>87; β^-<13	
^{192}Ir	−34833.2	1.7				73.827	d	0.013	4^+	98			β^-=95.13 14; ε=4.87 14	
^{192}Ir^m	−34776.5	1.7	56.720	0.005		1.45	m	0.05	1^-	98			IT≈100; β^-=0.0175	
^{192}Ir^n	−34665.1	1.7	168.14	0.12		241	y	9	(11^-)	98			IT=100	
^{192}Pt	−36292.9	2.5				STABLE			0^+	98			IS=0.782 7	
^{192}Au	−32777	16				4.94	h	0.09	1^-	98			β^+=100	
^{192}Au^m	−32642	16	135.41	0.25		29	ms		$5\#^+$	98			IT=100	
^{192}Au^n	−32345	16	431.6	0.5		160	ms	20	(11^-)	98			IT=100	
^{192}Hg	−32011	16				4.85	h	0.20	0^+	00			ε=100; α<4e–6	
^{192}Tl	−25870	30				9.6	m	0.4	(2^-)	99			β^+=100	
^{192}Tl^m	−25710	60	160	50		10.8	m	0.2	(7^+)	99	91Va04	E	β^+=100	
^{192}Tl^p	−25694	25	180	40	AD				(3^+)		91Va04	E		
^{192}Pb	−22556	13				3.5	m	0.1	0^+	98			β^+≈100; α=0.0059 7	
^{192}Pb^m	−19975	13	2581.1	0.1		164	ns	7	$(10)^+$	98			IT=100	
^{192}Pb^n	−19931	13	2625.1	1.1		1.1	μs	0.5	(12^+)	98			IT=100	
^{192}Pb^p	−19813	13	2743.5	0.4		756	ns	21	$(11)^-$	98			IT=100	
^{192}Bi	−13550	30				34.6	s	0.9	(3^+)	98			β^+=88 5; α=12 5	
^{192}Bi^m	−13399	9	150	30	MD	39.6	s	0.4	(10^-)	98			β^+=90 3; α=10 3	
^{192}Po	−8071	12				32.2	ms	0.3	0^+	98	99He32	T	α=?; β^+=0.5#	*
^{192}Po^m	−5470#	500#	2600#	500#		1	μs		$12^+\#$		99He32	T	IT=100	

*^{192}Os T : lower limit is for 0ν-2β^- decay **
*^{192}Po T : others 98Al27=31(4) 96Bi17=33.2(1.4) 81Le23=34(3) outweighed, not used **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{193}Re	−30300#	200#				30#	s	(>300 ns)	$5/2^+\#$		99Be63	I	β^- ?	
^{193}Os	−33392.6	2.6				30.11	h	0.01	$3/2^-$	98			β^-=100	
^{193}Ir	−34533.8	1.7				STABLE			$3/2^+$	98			IS=62.7 2	
^{193}Ir^m	−34453.6	1.7	80.240	0.006		10.53	d	0.04	$11/2^-$	98			IT=100	
^{193}Pt	−34477.0	1.7				50	y	6	$1/2^-$	98			ε=100	
^{193}Pt^m	−34327.2	1.7	149.78	0.04		4.33	d	0.03	$13/2^+$	98			IT=100	
^{193}Au	−33394	11				17.65	h	0.15	$3/2^+$	98			β^+=100; α<1e–5	
^{193}Au^m	−33104	11	290.19	0.03		3.9	s	0.3	$11/2^-$	98			IT≈100; β^+≈0.03	
^{193}Hg	−31051	15				3.80	h	0.15	$3/2^-$	99			β^+=100	
^{193}Hg^m	−30910	15	140.76	0.05		11.8	h	0.2	$13/2^+$	99			β^+=92.8 5; IT=7.2 5	
^{193}Tl	−27320	110				21.6	m	0.8	$1/2^{(+\#)}$	99			β^+=100	
^{193}Tl^m	−26950	110	369	4		2.11	m	0.15	$9/2^-$	99			IT=75; β^+=25	*
^{193}Pb	−22190	50			*	5#	m		$(3/2^-)$	99	ABBW	J	β^+ ?	*
^{193}Pb^m	−22060#	90#	130#	80#	*	5.8	m	0.2	$13/2^{(+)}$	99	88Me.A	J	β^+=100	
^{193}Bi	−15873	10				67	s	3	$(9/2^-)$	98			β^+ ?; α=3.5 15	
^{193}Bi^m	−15564	12	308	7	AD	3.2	s	0.6	$(1/2^+)$	98			α=90 20; β^+ ?	
^{193}Po	−8360	30				420	ms	40	$3/2^-\#$	98			α=?; β^+=5#	
^{193}Po^m	−8260#	50#	100#	30#		240	ms	10	$(13/2^+)$	98	ABBW	J	α=?; β^+=3#	
^{193}At	−150	50				40	ms		$9/2^-\#$	98			α=100	

*^{193}Tl^m E : less than 13 keV above 362.5 level, from ENSDF **
*^{193}Pb J : from α decay from ^{197}Po **
*^{193}Pb T : T=4.0 m reported in Karlsruhe charts 1981 and 1995. Not traceable **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{194}Re	−27550#	300#				2#	s	(>300 ns)			99Be63	I	β^- ?	
^{194}Os	−32432.7	2.6				6.0	y	0.2	0^+	96			β^-=100	
^{194}Ir	−32529.3	1.7				19.28	h	0.13	1^-	96			β^-=100	
^{194}Ir^m	−32382.2	1.7	147.078	0.005		31.85	ms	0.24	(4^+)	96			IT=100	
^{194}Ir^n	−32160	70	370	70	BD	171	d	11	$(10,11)^{(-\#)}$	96			β^-=100	
^{194}Pt	−34763.1	0.9				STABLE			0^+	96			IS=32.967 99	
^{194}Au	−32262	10				38.02	h	0.10	1^-	96			β^+=100	
^{194}Au^m	−32155	10	107.4	0.5		600	ms	8	(5^+)	96			IT=100	
^{194}Au^n	−31786	10	475.8	0.6		420	ms	10	(11^-)	96			IT=100	
^{194}Hg	−32193	13				440	y	80	0^+	01			ε=100	

. . . A-group is continued on next page . . .

. . . A-group continued . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{194}Tl	−26830	140				*	33.0	m	0.5	2^-	99			β^+=100; α<1e–7	
^{194}Tl^m	−26530#	240#	300#	200#		*	32.8	m	0.2	(7^+)	99			β^+=100	
^{194}Pb	−24208	17					12.0	m	0.5	0^+	99			β^+=100; α=7.3e–6 29	
^{194}Bi	−15990	50				*	95	s	3	(3^+)	96			$\beta^+\approx$100; α=0.46 25	
^{194}Bi^m	−15880	50	110	70	MD	*	125	s	2	$(6^+,7^+)$	96			$\beta^+\approx$100; α ?	
^{194}Bi^n	−15760#	70#	230#	90#			115	s	4	(10^-)	96			$\beta^+\approx$100; α=0.20 7	
^{194}Po	−11005	13					392	ms	4	0^+	96			$\alpha\approx$100; β^+ ?	
^{194}Po^m	−8480	13	2525	2			15	μs	2	(11^-)		99He32	TJD	IT=100	
^{194}At	−1190	190					40	ms		3^+#	96			$\alpha\approx$100; β^+ ?	
^{194}At^m	−711	17	480	190	AD		250	ms		10^-#	96			$\alpha\approx$100; IT ?	
^{195}Os	−29690	500					6.5	m		$3/2^-$#	99			β^-=100	*
^{195}Ir	−31689.8	1.7					2.5	h	0.2	$3/2^+$	99			β^-=100	
^{195}Ir^m	−31590	5	100	5			3.8	h	0.2	$11/2^-$	99			β^-=95 5; IT=5 5	
^{195}Pt	−32796.8	0.9					STABLE			$1/2^-$	99			IS=33.832 10	
^{195}Pt^m	−32537.5	0.9	259.30	0.08			4.02	d	0.01	$13/2^+$	99			IT=100	
^{195}Au	−32570.0	1.3					186.10	d	0.05	$3/2^+$	99			ε=100	
^{195}Au^m	−32251.4	1.3	318.58	0.04			30.5	s	0.2	$11/2^-$	99			IT=100	
^{195}Hg	−31000	23					10.53	h	0.03	$1/2^-$	99	01Li17	T	β^+=100	
^{195}Hg^m	−30824	23	176.07	0.04			41.6	h	0.8	$13/2^+$	99			IT=54.2 20; β^+=45.8 20	
^{195}Tl	−28155	14					1.16	h	0.05	$1/2^+$	99			β^+=100	
^{195}Tl^m	−27672	14	482.63	0.17			3.6	s	0.4	$9/2^-$	99			IT=100	
^{195}Pb	−23714	23					15	m		$3/2$#$^-$	99			β^+=100	
^{195}Pb^m	−23511	23	202.9	0.7			15.0	m	1.2	$13/2^+$	99			β^+=100	
^{195}Bi	−18024	6					183	s	4	$(9/2^-)$	99	ABBW	J	$\beta^+\approx$100; α=0.03 2	
^{195}Bi^m	−17624	8	399	6	AD		87	s	1	$(1/2^+)$	99	ABBW	J	β^+=67 17; α=33 17	*
^{195}Po	−11070	40					4.64	s	0.09	$3/2^-$#	99			α=75 15; β^+=25 15	
^{195}Po^m	−10964	28	110	50	AD		1.92	s	0.02	$13/2^+$#	99			$\alpha\approx$90; $\beta^+\approx$10; IT<0.01	
^{195}At	−3476	9				&	328	ms	20	$(1/2^+)$	00	03Ke04	T	$\alpha\approx$100; β^+ ?	
^{195}At^m	−3443	8	34	7	AD	&	147	ms	5	$9/2^-$#	00	03Ke04	T	α=?; β^+<25#	
^{195}Rn	5070	50				*	6	ms		$3/2^-$#		01Ke06	TD	α=?	
^{195}Rn^m	5118	15	50	50		*	6	ms		$13/2^+$#		01Ke06	TD	α=?	

*^{195}Os I : identification of this nuclide has been questioned, see ENSDF'99 **
*^{195}Bi^m J : spins of ground-state and of isomer derived from alpha decay **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{196}Os	−28280	40					34.9	m	0.2	0^+	98			β^-=100	
^{196}Ir	−29440	40					52	s	1	(0^-)	98			β^-=100	
^{196}Ir^m	−29229	20	210	40	BD		1.40	h	0.02	$(10,11^-)$	98			$\beta^-\approx$100; IT<0.3	
^{196}Pt	−32647.4	0.9					STABLE			0^+	98			IS=25.242 41	
^{196}Au	−31140.0	3.0					6.1669	d	0.0006	2^-	98	01Li17	T	β^+=92.8 8; β^-=7.2 8	
^{196}Au^m	−31055	3	84.660	0.020			8.1	s	0.2	5^+	98			IT=100	
^{196}Au^n	−30544	3	595.66	0.04			9.6	h	0.1	12^-	98			IT=100	
^{196}Hg	−31826.7	2.9					STABLE		(>2.5 Ey)	0^+	98	90Bu28	T	IS=0.15 1; 2β^+ ?	
^{196}Tl	−27497	12					1.84	h	0.03	2^-	98			β^+=100	
^{196}Tl^m	−27103	12	394.2	0.5			1.41	h	0.02	(7^+)	98			β^+=95.5; IT=4.5	
^{196}Pb	−25361	14					37	m	3	0^+	01			β^+=100; $\alpha\leq$3e–5	
^{196}Pb^m	−23623	14	1738.27	0.12			< 1	μs		4^+	01			IT=100	
^{196}Bi	−18009	24					5.1	m	0.2	(3^+)	99			$\beta^+\approx$100; α=0.00115 34	
^{196}Bi^m	−17842	25	166.6	3.0	AD		0.6	s	0.5	(7^+)	99			IT=?; β^+ ?	
^{196}Bi^n	−17739	25	270	3	AD		4.00	m	0.05	(10^-)	99			β^+=74.2 25; IT=25.8 25;...	*
^{196}Po	−13474	13					5.56	s	0.12	0^+	98	93Wa04	TD	α=94 5; β^+=6 5	*
^{196}Po^m	−10984	13	2490.5	1.7			850	ns	90	(11^-)	98			IT=100	
^{196}At	−3920	60				*	253	ms	9	3^+#	98	97Pu01	T	α=?; β^+=4#	
^{196}At^m	−3950	50	−30	80	AD	*	20#	ms		10^-#		96En01	D	IT ?	
^{196}At^n	−3760	60	157.9	0.1			11	μs		5^+#		00Sm06	ET	IT ?	
^{196}Rn	1970	15					4.7	ms	1.1	0^+	98	01Ke06	T	$\alpha\approx$100; β^+=0.2#	

*^{196}Bi^n D : . . . ; α=0.00038 10 **
*^{196}Po T : average 97Pu01=5.5(0.1) 93Wa04=5.8(0.2) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{197}Ir	−28268	20				5.8	m	0.5	$3/2^+$	96			β^-=100	
^{197}Ir^m	−28153	21	115	5		8.9	m	0.3	$11/2^-$	96			$\beta^-\approx$100; IT=0.25 10	
^{197}Pt	−30422.4	0.8				19.8915	h	0.0019	$1/2^-$	96			β^-=100	
^{197}Pt^m	−30022.8	0.8	399.59	0.20		95.41	m	0.18	$13/2^+$	96			IT=96.7 4; β^-=3.3 4	
^{197}Au	−31141.1	0.6				STABLE			$3/2^+$	96			IS=100.	
^{197}Au^m	−30732.0	0.6	409.15	0.08		7.73	s	0.06	$11/2^-$	96			IT=100	
^{197}Hg	−30541	3				64.94	h	0.07	$1/2^-$	96	01Li17	T	ε=100	*
^{197}Hg^m	−30242	3	298.93	0.08		23.8	h	0.1	$13/2^+$	96			IT=91.4 7; ε=8.6 7	
^{197}Tl	−28341	16				2.84	h	0.04	$1/2^+$	96			β^+=100	
^{197}Tl^m	−27733	16	608.22	0.08		540	ms	10	$9/2^-$	96			IT=100	
^{197}Pb	−24749	6				8	m	2	$3/2^-$	01			β^+=100	
^{197}Pb^m	−24429	6	319.31	0.11		43	m	1	$13/2^+$	01			β^+=81 2; IT=19 2; ...	*
^{197}Pb^n	−22835	6	1914.10	0.25		1.15	μs	0.20	$21/2^-$	01			IT=100	
^{197}Bi	−19688	8				9.3	m	0.5	$(9/2^-)$	99			β^+=100; α=1e–4#	
^{197}Bi^m	−19000	110	690	110	AD	5.04	m	0.16	$(1/2^+)$	99			α=55 40; β^+=45 40; ...	*
^{197}Po	−13360	50				53.6	s	1.0	$(3/2^-)$	96			β^+ ?; α=44 7	
^{197}Po^m	−13120#	90#	230#	80#		25.8	s	0.1	$(13/2^+)$	96			α=84 9; β^+ ?; IT=0.01#	
^{197}At	−6340	50			*	350	ms	40	$(9/2^-)$	96			α=96 4; β^+=4 4	
^{197}At^m	−6293	13	50	50	AD *	3.7	s	2.5	$(1/2^+)$	96			$\alpha\approx$100; β^+ ?; IT$<$0.004	
^{197}Rn	1480	60				66	ms	16	$3/2^-$#	98	96En02	T	$\alpha\approx$100; β^+ ?	*
^{197}Rn^m	1670#	50#	200#	60#		21	ms	5	$(13/2^+)$	98	96En02	T	$\alpha\approx$100; β^+ ?	*

*^{197}Hg T : other 66El09=64.14(0.05) at strong variance: Birge ratio would be B=9.3 **
*^{197}Pb^m D : ... ; $\alpha<$3e–4 **
*^{197}Bi^m D : ... ; IT$<$0.3 **
*^{197}Rn T : average 96En02=65(+25–14) 95Mo14=51(+35–15) **
*^{197}Rn^m T : average 96En02=19(+8–4) 95Mo14=18(+9–5) J : from α decay to ^{193}Po^m **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{198}Ir	−25820#	200#				8	s	1		02			β^-=100	
^{198}Pt	−29908	3				STABLE		(>320 Ty)	0^+	02	52Fr23	T	IS=7.163 55; 2β^- ?; α ?	*
^{198}Au	−29582.1	0.6				2.69517	d	0.00021	2^-	02			β^-=100	
^{198}Au^m	−29269.9	0.6	312.2200	0.0020		124	ns	4	5^+	02			IT=100	
^{198}Au^n	−28770.4	1.6	811.7	1.5		2.27	d	0.02	(12^-)	02			IT=100	
^{198}Hg	−30954.4	0.3				STABLE			0^+	02			IS=9.97 20	
^{198}Tl	−27490	80				5.3	h	0.5	2^-	02			β^+=100	
^{198}Tl^m	−26950	80	543.5	0.4		1.87	h	0.03	7^+	02			β^+=54 2; IT=46 2	
^{198}Tl^n	−26750	80	742.3	0.4		32.1	ms	1.0	10^-#	02			IT=100	
^{198}Pb	−26050	15				2.4	h	0.1	0^+	02			β^+=100	
^{198}Pb^m	−23909	15	2141.4	0.4		4.19	μs	0.10	$(7)^-$	02			IT=100	
^{198}Bi	−19369	28				10.3	m	0.3	$(2^+,3^+)$	02			β^+=100	
^{198}Bi^m	−19085	28	280	40	MD	11.6	m	0.3	(7^+)	02			β^+=100	
^{198}Bi^n	−18837	28	530	40	MD	7.7	s	0.5	10^-	02			IT=100	*
^{198}Po	−15473	17				1.77	m	0.03	0^+	02			α=57 2; β^+=43 2	
^{198}Po^m	−13619	17	1853.63	0.18		29	ns	2	8^+	02			IT=100	
^{198}Po^n	−12907	17	2565.92	0.20		200	ns	20	11^-	02			IT=100	
^{198}Po^p	−12781	17	2691.86	0.20		750	ns	50	12^+	02			IT ?	
^{198}At	−6670	50				4.2	s	0.3	(3^+)	02	95Bi.A	D	$\alpha>$94; β^+ ?	
^{198}At^m	−6340#	70#	330#	90#		1.0	s	0.2	(10^-)	02	95Bi.A	D	$\alpha>$86; β^+ ?	
^{198}Rn	−1231	13				65	ms	3	0^+	02			α=?; β^+=1#	
^{198}Rn^m			non existent		EU	50	ms	9					α=?; β^+=?; IT=?	*

*^{198}Pt T : lower limit is for 0ν-2β^- decay **
*^{198}Bi^n E : 248.5(0.5) keV above ^{198}Bi^m, from 92Hu04 **
*^{198}Rn^m I : α decay assigned to isomer by ENSDF'95, not accepted by NUBASE **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{199}Ir	−24400	40				20#	s		$3/2^+$#	01			β^- ?	
^{199}Pt	−27392	3				30.80	m	0.21	$5/2^-$	94			β^-=100	
^{199}Pt^m	−26968	4	424	2		13.6	s	0.4	$(13/2)^+$	94			IT=100	
^{199}Au	−29095.0	0.6				3.139	d	0.007	$3/2^+$	94			β^-=100	
^{199}Au^m	−28546.1	0.6	548.9368	0.0021		440	μs	30	$(11/2)^-$	94			IT=100	
^{199}Hg	−29547.1	0.4				STABLE			$1/2^-$	94			IS=16.87 22	
^{199}Hg^m	−29014.6	0.4	532.48	0.10		42.66	m	0.08	$13/2^+$	94	01Li17	T	IT=100	*

... A-group is continued on next page ...

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .															
^{199}Tl	−28059	28					7.42	h	0.08	$1/2^+$	94			β^+=100	
^{199}Tl^m	−27309	28	749.7	0.3			28.4	ms	0.2	$9/2^-$	94			IT=100	
^{199}Pb	−25228	26					90	m	10	$3/2^-$	01			β^+=100	
^{199}Pb^m	−24799	26	429.5	2.7			12.2	m	0.3	$(13/2^+)$	01	ABBW	E	IT=93; β^+=7	*
^{199}Pb^n	−22664	26	2563.8	2.7			10.1	μs	0.2	$(29/2^-)$	01	ABBW	E	IT=100	*
^{199}Bi	−20798	12					27	m	1	$9/2^-$	94			β^+=100	
^{199}Bi^m	−20131	12	667	4			24.70	m	0.15	$(1/2^+)$	94			β^+=?; IT<2; $\alpha\approx$0.01	
^{199}Po	−15215	23					5.48	m	0.16	$(3/2^-)$	94			β^+=92.5 3; α=7.5 3	
^{199}Po^m	−14903	23	312.0	2.8	AD		4.17	m	0.04	$13/2^+$	94			β^+=73.5 10; α=24 1; IT=2.5	
^{199}At	−8820	50					7.2	s	0.5	$(9/2^-)$	94			α=89 6; β^+ ?	
^{199}Rn	−1520	60					620	ms	30	$3/2^-$#	98			α=?; β^+=6#	
^{199}Rn^m	−1334	29	180	70	AD		320	ms	20	$13/2^+$#	98			α=?; β^+=3#	
^{199}Fr	6760	40					16	ms	7	$1/2^+$#	01	99Ta20	T	$\alpha\approx$100; β^+ ?	

*^{199}Hg^m T : average 01Li17=42.67(0.09) 69Kl06=42.6(0.2) **
*^{199}Pb^m E : 424.8 γ to level lower than 9.3 keV, from ENSDF D : from 78Le.A **
*^{199}Pb^n E : 2559.1 to level lower than 9.3 keV, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{200}Pt	−26603	20					12.5	h	0.3	0^+	95			β^-=100	
^{200}Au	−27270	50					48.4	m	0.3	$1^{(-)}$	95			β^-=100	
^{200}Au^m	−26300	50	970	70	BD		18.7	h	0.5	12^-	95			β^-=82 2; IT=18 2	
^{200}Hg	−29504.1	0.4					STABLE			0^+	95			IS=23.10 19	
^{200}Tl	−27048	6					26.1	h	0.1	2^-	95			β^+=100	
^{200}Tl^m	−26294	6	753.6	0.2			34.3	ms	1.0	7^+	95			IT=100	
^{200}Pb	−26243	11					21.5	h	0.4	0^+	95			ε=100	
^{200}Bi	−20370	24				*	36.4	m	0.5	7^+	95			β^+=100	
^{200}Bi^m	−20270#	70#	100#	70#		*	31	m	2	(2^+)	95			β^+>90; IT<10	
^{200}Bi^n	−19942	24	428.20	0.10			400	ms	50	(10^-)	95			IT=100	
^{200}Po	−16954	14					11.5	m	0.1	0^+	95			β^+=88.9 3; α=11.1 3	
^{200}At	−8988	24					43.2	s	0.9	(3^+)	95	96Ta18	T	α=57 6; β^+=43 6	*
^{200}At^m	−8875	25	112.7	3.0	AD		47	s	1	(7^+)	95			α=43 7; β^+=?; IT ?	
^{200}At^n	−8644	24	344	3	AD		3.5	s	0.2	(10^-)	95			IT$\approx$84; $\alpha\approx$10.5; $\beta^+\approx$4.5	*
^{200}Rn	−4006	13					1.03	s	0.05	0^+	98	96Ta18	T	α=?; β^+=2#	*
^{200}Fr	6120	80				*	24	ms	10	3^+#	97	96En01	TD	α=100	
^{200}Fr^m	6180	70	60	110	AD	*	650	ms	210	10^-#	97	95Mo14	TD	$\alpha\approx$100; IT ?	

*^{200}At T : average 96Ta18=44(2) 92Hu04=43(1) **
*^{200}At^n E : 230.9(0.2) keV above ^{200}At^m, from ENSDF **
*^{200}Rn T : average 96Ta18=0.96(0.03) 84Ca32=1.06(0.02) **

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{201}Pt	−23740	50					2.5	m	0.1	$(5/2^-)$	94			β^-=100	
^{201}Au	−26401	3					26	m	1	$3/2^+$	94			β^-=100	
^{201}Hg	−27663.3	0.6					STABLE			$3/2^-$	94			IS=13.18 9	
^{201}Hg^m	−26897.1	0.6	766.23	0.15			94	μs		$13/2^+$					
^{201}Tl	−27182	15					72.912	h	0.017	$1/2^+$	94			ε=100	
^{201}Tl^m	−26263	15	919.50	0.09			2.035	ms	0.007	$(9/2^-)$	94			IT=100	
^{201}Pb	−25258	22					9.33	h	0.03	$5/2^-$	94			β^+=100	
^{201}Pb^m	−24629	22	629.14	0.17			61	s	2	$13/2^+$	94			IT>99; β^+<1	
^{201}Bi	−21416	15					108	m	3	$9/2^-$	94			β^+=100; α<1e–4	
^{201}Bi^m	−20570	15	846.34	0.21			59.1	m	0.6	$1/2^+$	94			β^+=92.9#; IT<6.8; α=?	*
^{201}Po	−16525	6					15.3	m	0.2	$3/2^-$	94			β^+=98.4 3; α=1.6 3	
^{201}Po^m	−16101	6	424.1	2.4	AD		8.9	m	0.2	$13/2^+$	94			IT=56 14; β^+=41 10; $\alpha\approx$2.9	
^{201}At	−10789	8					85	s	3	$(9/2^-)$	94	96Ta18	T	α=71 7; β^+=29 7	*
^{201}Rn	−4070	70					7.0	s	0.4	$(3/2^-)$	94	96Ta18	T	α=?; β^+=20#	*
^{201}Rn^m	−3790#	90#	280#	90#			3.8	s	0.1	$(13/2^+)$	94	96Ta18	T	α=?; β^+=10#; IT=0.01#	
^{201}Fr	3600	70					61	ms	12	$(9/2^-)$	94	96En01	T	$\alpha\approx$100; β^+<1	*

*^{201}Bi^m D : α decay is observed. Its branching ratio is estimated 0.3%# in ENSDF **
*^{201}At T : average 96Ta18=83(2) and two results in ENSDF=89(3) **
*^{201}Rn T : average 96Ta18=7.1(0.8) 71Ho01=7.0(0.4) **
*^{201}Fr T : average 96En01=69(+16–11) 80Ew03=48(15) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{202}Pt	−22600#	300#				44	h	15	0^+	97			β^-=100	
^{202}Au	−24400	170				28.8	s	1.9	(1^-)	97			β^-=100	
^{202}Hg	−27345.9	0.6				STABLE			0^+	97			IS=29.86 26	*
^{202}Tl	−25983	15				12.23	d	0.02	2^-	97			β^+=100	
^{202}Tl^m	−25033	15	950.19	0.10		572	μs	7	7^+	97				
^{202}Pb	−25934	8				52.5	ky	2.8	0^+	97			$\varepsilon\approx$100; $\alpha<$1#	
^{202}Pb^m	−23764	8	2169.83	0.07		3.53	h	0.01	9^-	97			IT=90.5 5; β^+=9.5 5	
^{202}Bi	−20733	20				1.72	h	0.05	$5^{(+\#)}$	97			β^+=100; $\alpha<$1e–5	*
^{202}Bi^m	−20118	21	615	7		3.04	μs	0.06	$(10\#)^-$	97				
^{202}Po	−17924	15				44.7	m	0.5	0^+	97			β^+=?; α=1.92 7	
^{202}Po^m	−15297	15	2626.7	0.7		> 200	ns		11^-	97			IT=100	
^{202}At	−10591	28				184	s	1	$(2,3)^+$	97			β^+=?; α=18 3	
^{202}At^m	−10401	28	190	40	MD	182	s	2	(7^+)	97			IT ?; β^+ ?; α=8.7 15	
^{202}At^n	−10010	28	580	40	MD	460	ms	50	(10^-)	97	92Hu04	E	IT$\approx$100; β^+=0.25#; . . .	*
^{202}Rn	−6275	18				9.94	s	0.18	0^+	97	96Ta18	T	α=?; β^+=14#	*
^{202}Fr	3140	50				290	ms	30	(3^+)	97	96En01	T	α=?; β^+=3#	*
^{202}Fr^m	3470#	70#	330#	90#		340	ms	40	(10^-)	97			α=?; β^+=3#	
^{202}Ra	9210	60				2.6	ms	2.1	0^+	98	96Le09	TD	α=100	

*^{202}Hg D : lower half-life limit for ^{24}Ne decay $T>$3.7 Zy, from 90Bu28 **
*^{202}Bi J : re-evaluation to a possible 6^+ is discussed in 96Ca02 **
*^{202}At^n D : . . . ; α=0.096 11 **
*^{202}At^n E : 391.7(0.5) keV above ^{202}At^m **
*^{202}Rn T : average 96Ta18=10.3(0.4) 71Ho01=9.85(0.20) **
*^{202}Fr T : average 96En01=230(+80–40) 95Bi.A=300(40) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{203}Au	−23143	3				53	s	2	$3/2^+$	93			β^-=100	
^{203}Hg	−25269.1	1.7				46.612	d	0.018	$5/2^-$	93			β^-=100	
^{203}Hg^m	−24336.0	2.0	933.1	1.0		24	μs		$(13/2^+)$					
^{203}Tl	−25761.2	1.3				STABLE			$1/2^+$	93			IS=29.524 14	
^{203}Tl^m	−22360	300	3400	300		7.7	μs	0.5	$(25/2^+)$		98Pf02	TJ	IT=100	
^{203}Pb	−24787	7				51.873	h	0.009	$5/2^-$	93			ε=100	
^{203}Pb^m	−23962	7	825.20	0.09		6.3	s	0.2	$13/2^+$	93			IT=100	
^{203}Pb^n	−21838	7	2949.47	0.22		480	ms	20	$29/2^-$	93			IT=100	
^{203}Bi	−21540	22				11.76	h	0.05	$9/2^-$	93			β^+=100; $\alpha\approx$1e–5	
^{203}Bi^m	−20442	22	1098.14	0.07		303	ms	5	$1/2^+$	93			IT=100	
^{203}Po	−17307	26				36.7	m	0.5	$5/2^-$	93			$\beta^+\approx$100; α=0.11 2	
^{203}Po^m	−16666	26	641.49	0.17		45	s	2	$13/2^+$	93			IT$\approx$100; α=0.04#	
^{203}At	−12163	12				7.4	m	0.2	$9/2^-$	93			β^+=69 3; α=31 3	
^{203}Rn	−6160	24				43.5	s	2.1	$(3/2,5/2)^-$	93	96Ta18	T	α=66 9; β^+=34 9	*
^{203}Rn^m	−5798	24	363	4	AD	26.7	s	0.5	$13/2^{(+)}$	93	87Bo29	J	α=?; β^+=20#	*
^{203}Fr	861	16				550	ms	20	$9/2^-\#$	98			α=?; β^+=5#	
^{203}Ra	8640	80				4	ms	3	$(3/2^-)$	98	96Le09	TJD	$\alpha\approx$100; β^+ ?	
^{203}Ra^m	8860	40	220	90	AD	41	ms	17	$(13/2^+)$	98	96Le09	TJD	$\alpha\approx$100; β^+ ?	

*^{203}Rn T : average 96Ta18=42(3) 71Ho01=45(3) **
*^{203}Rn^m T : from 96Ta18 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{204}Au	−20750#	200#				39.8	s	0.9	(2^-)	94			β^-=100	
^{204}Hg	−24690.2	0.3				STABLE			0^+	94			IS=6.87 15; $2\beta^-$?	
^{204}Tl	−24346.0	1.3				3.78	y	0.02	2^-	94			β^-=97.10 12; ε=2.90 12	
^{204}Tl^m	−23242.0	1.4	1104.0	0.4		63	μs	2	$(7)^+$	94			IT=100	
^{204}Tl^n	−21850	500	2500	500		2.6	μs	0.2	(12^-)		98Pf02	TJ	IT=100	
^{204}Tl^p	−20850	500	3500	500		1.6	μs	0.2	(20^+)		98Pf02	TJ	IT=100	
^{204}Pb	−25109.7	1.2				STABLE		(>140 Py)	0^+	94			IS=1.4 1; α ?	
^{204}Pb^m	−22923.9	1.2	2185.79	0.05		67.2	m	0.3	9^-	94			IT=100	
^{204}Bi	−20667	26				11.22	h	0.10	6^+	94			β^+=100	
^{204}Bi^m	−19862	26	805.5	0.3		13.0	ms	0.1	10^-	94			IT=100	
^{204}Bi^n	−17834	26	2833.4	1.1		1.07	ms	0.03	(17^+)	94			IT=100	
^{204}Po	−18334	11				3.53	h	0.02	0^+	94			β^+=99.34 1; α=0.66 1	

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .															
^{204}At	−11875	24					9.2	m	0.2	7^+	94			β^+=96.2 2; α=3.8 2	
^{204}At^m	−11288	24	587.30	0.20			108	ms	10	(10^-)	94			IT=100	
^{204}Rn	−7984	15					1.24	m	0.03	0^+	95			α=73 1; β^+ ?	
^{204}Fr	608	25					1.7	s	0.3	(3^+)	94	95Bi.A	D	α=96 2; β^+ ?	
^{204}Fr^m	658	25	50	4	AD		2.6	s	0.3	(7^+)	94	95Bi.A	D	α=90 2; β^+ ?	
^{204}Fr^n	934	25	326	4	AD		1.7	s	0.6	(10^-)	94	94Le05	T	α=74 8; IT=26 8	*
^{204}Ra	6054	15					60	ms	11	0^+	98	95Le04	T	$\alpha\approx$100; β^+=0.3#	*
*^{204}Fr^n	E : 276.1 keV above ^{204}Fr^m, from 95Bi.A						D : α intensity is from 95Bi.A								**
*^{204}Ra	T : average 95Le04=45(+55–21) 96Le09=59(+12–9)														**
^{205}Au	−18750#	300#					31	s	2	$3/2^+$	97	94We02	T	β^-=100	
^{205}Hg	−22287	4					5.2	m	0.1	$1/2^-$	98			β^-=100	
^{205}Hg^m	−20730	4	1556.53	0.24			1.10	ms	0.04	$(13/2^+)$	98			IT=100	
^{205}Tl	−23820.6	1.3					STABLE			$1/2^+$	93			IS=70.476 14	
^{205}Tl^m	−20530.0	1.3	3290.63	0.17			2.6	μs	0.2	$25/2^+$	93			IT=100	
^{205}Pb	−23770.1	1.2					15.3	My	0.7	$5/2^-$	93			ε=100	
^{205}Pb^m	−22756.3	1.2	1013.839	0.013			5.54	ms	0.10	$13/2^+$	93			IT=100	
^{205}Pb^n	−20574.5	1.4	3195.6	0.8			217	ns	5	$25/2^-$	93			IT=100	
^{205}Bi	−21062	7					15.31	d	0.04	$9/2^-$	93			β^+=100	
^{205}Po	−17509	20					1.66	h	0.02	$5/2^-$	93			$\beta^+\approx$100; α=0.04 1	
^{205}Po^m	−16048	20	1461.20	0.21			58	ms	1	$19/2^-$	93			IT=100	
^{205}Po^n	−16629	20	880.30	0.04			645	μs		$13/2^+$					
^{205}At	−12972	15					26.2	m	0.5	$9/2^-$	93			β^+=90 2; α=10 2	
^{205}At^m	−10909	15	2062.57	0.25			67.9	ns		$25/2^+$					
^{205}At^n	−10632	15	2339.60	0.25			7.8	μs		$29/2^+$					
^{205}Rn	−7710	50					2.8	m	0.1	$5/2^-$	93			β^+=77 4; α=23 4	
^{205}Fr	−1310	8					3.85	s	0.10	$(9/2^-)$	93			$\alpha\approx$100; β^+<1	
^{205}Ra	5840	90					220	ms	40	$(3/2^-)$	93	96Le09	TJ	α=?; β^+ ?	*
^{205}Ra^m	6150#	100#	310#	110#			180	ms	50	$(13/2^+)$		96Le09	TJD	α=?; IT ?	
*^{205}Ra	T : average 96Le09=210(+60–40) 87He10=220(60)														**
^{206}Hg	−20946	20					8.15	m	0.10	0^+	99			β^-=100	
^{206}Tl	−22253.1	1.4					4.200	m	0.017	0^-	99			β^-=100	
^{206}Tl^m	−19610.0	1.4	2643.11	0.19			3.74	m	0.03	(12^-)	99			IT=100	
^{206}Pb	−23785.4	1.2					STABLE			0^+	99			IS=24.1 1	
^{206}Pb^m	−21585.3	1.2	2200.14	0.04			125	μs	2	7^-	99			IT=100	
^{206}Pb^n	−19758.1	1.4	4027.3	0.7			202	ns	3	12^+	99			IT=100	
^{206}Bi	−20028	8					6.243	d	0.003	$6^{(+)}$	99			β^+=100	
^{206}Bi^m	−19968	8	59.897	0.017			7.7	μs	0.2	(4^+)	99			IT=100	
^{206}Bi^n	−18983	8	1044.8	0.5			890	μs	10	(10^-)	99			IT=100	
^{206}Po	−18182	8					8.8	d	0.1	0^+	99			β^+=94.55 5; α=5.45 5	
^{206}Po^m	−16596	8	1585.85	0.11			222	ns	10	8^+#	99			IT=100	*
^{206}Po^n	−15920	8	2262.22	0.14			1.05	μs	0.06	9^-#	99			IT=100	
^{206}At	−12420	20					30.6	m	1.3	$(5)^+$	99			β^+=99.11 8; α=0.89 8	
^{206}At^m	−11613	20	807	3			410	ns	80	$(10)^-$		99Fe10	ETJ	IT=100	
^{206}Rn	−9116	15					5.67	m	0.17	0^+	99			α=62 3; β^+=38 3	
^{206}Fr	−1243	28					16	s		$(2^+,3^+)$	99	92Hu04	D	β^+=?; α=42 24	*
^{206}Fr^m	−1048	28	190	40	MD		15.9	s	0.1	(7^+)	99	92Hu04	D	α=42 24; β^+ ?; IT ?	
^{206}Fr^n	−517	28	730	40	MD		700	ms	100	(10^-)	99			IT=?; $\alpha\approx$12#	*
^{206}Ra	3565	18					240	ms	20	0^+	99			α=100	
^{206}Ac	13510	70				* &	25	ms	7	(3^+)	99			$\alpha\approx$100; β^+=0.2#	
^{206}Ac^m	13590	90	80	50		* &	15	ms	6		99			$\alpha\approx$100	
^{206}Ac^n	13800#	80#	290#	110#		&	41	ms	16	(10^-)	99			$\alpha\approx$100	
*^{206}Po^m	E : less than 40 keV above 1573.4 level, from ENSDF														**
*^{206}Fr	D : α=84(2)% for mixture of ^{206}Fr and ^{206}Fr^m, in 92Hu04. Value replaced by														**
*^{206}Fr	D : uniform distribution 0%-84% for each isomer														**
*^{206}Fr^n	E : 531 keV above ^{206}Fr^m, from ENSDF														**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{207}Hg	−16220	150				2.9	m	0.2	$(9/2^+)$	94			β^-=100	
^{207}Tl	−21034	5				4.77	m	0.02	$1/2^+$	94			β^-=100	
^{207}Tl^m	−19686	5	1348.1	0.3		1.33	s	0.11	$11/2^-$	94			IT≈100; β^-<0.1#	
^{207}Pb	−22451.9	1.2				STABLE			$1/2^-$	94			IS=22.1 1	
^{207}Pb^m	−20818.5	1.2	1633.368	0.005		806	ms	6	$13/2^+$	94			IT=100	
^{207}Bi	−20054.4	2.4				32.9	y	1.4	$9/2^-$	94			β^+=100	
^{207}Bi^m	−17952.9	2.4	2101.49	0.16		182	μs	6	$21/2^+$	94			IT=100	
^{207}Po	−17146	7				5.80	h	0.02	$5/2^-$	94			β^+≈100; α=0.021 2	
^{207}Po^m	−15763	7	1383.15	0.06		2.79	s	0.08	$19/2^-$	94			IT=100	
^{207}Po^n	−16031	7	1115.073	0.016		49	μs		$13/2^+$					
^{207}At	−13243	21				1.80	h	0.04	$9/2^-$	94			β^+=91.4 10; α=8.6 10	
^{207}Rn	−8631	26				9.25	m	0.17	$5/2^-$	94			β^+=79 3; α=21 3	
^{207}Rn^m	−7732	26	899.0	1.0		181	μs	18	$(13/2^+)$	94			IT=100	
^{207}Fr	−2840	50				14.8	s	0.1	$9/2^-$	94			α=95 2; β^+=5 2	
^{207}Ra	3540	60				1.3	s	0.2	$(5/2^-,3/2^-)$	94			α≈90; β^+≈10	
^{207}Ra^m	4095	25	560	50	AD	57	ms	8	$(13/2^+)$	94	96Le09	T	IT=85#; α=?; …	*
^{207}Ac	11130	50				31	ms	8	$9/2^-$#	98	94Le05	TD	α=100	*

*^{207}Ra^m D : … ; β^+=0.55# **
*^{207}Ra^m T : average 96Le09=63(16) 87He10=55(10) **
*^{207}Ac T : average 98Es02=27(+11–6) 94Le05=22(+40–9) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{208}Hg	−13100#	300#				42	m	5	0^+	98	98Zh22	T	β^-=100	*
^{208}Tl	−16749.5	2.0				3.053	m	0.004	$5^{(+)}$	98			β^-=100	
^{208}Pb	−21748.5	1.2				STABLE			0^+	96			IS=52.4 1	
^{208}Pb^m	−16853.5	2.3	4895	2		500	ns	10	10^+	86	98Pf02	T	IT=100	
^{208}Bi	−18870.0	2.4				368	ky	4	$(5)^+$	86			β^+=100	
^{208}Bi^m	−17298.9	2.4	1571.1	0.4		2.58	ms	0.04	$(10)^-$	86			IT=100	
^{208}Po	−17469.5	1.8				2.898	y	0.002	0^+	86			α≈100; β^+=0.00223 23	
^{208}At	−12491	26				1.63	h	0.03	6^+	86			β^+=99.45 6; α=0.55 6	
^{208}Rn	−9648	11				24.35	m	0.14	0^+	86			α=62 7; β^+=38 7	
^{208}Fr	−2670	50				59.1	s	0.3	7^+	86			α=90 4; β^+=10 4	
^{208}Ra	1714	15				1.3	s	0.2	0^+	86			α=?; β^+=5#	
^{208}Ra^m	3510	200	1800	200		270	ns		(8^+)		98Le.A	ETJ		
^{208}Ac	10760	60				97	ms	16	(3^+)	96	96Ik01	T	α=?; β^+=1#	*
^{208}Ac^m	11258	28	500	50	AD	28	ms	7	(10^-)	96	96Ik01	T	α=?; IT<10#; β^+=1#	*

*^{208}Hg T : 98Zh22=41(+5–4) supersedes 94Zh02=42(+23–12) of same group **
*^{208}Ac T : average 96Ik01=83(+34–19) 94Le05=95(+24–16) **
*^{208}Ac^m E : if α decay goes to (7^+) ^{204}Fr^m, instead of (10^-) as assumed in AME, then **
*^{208}Ac^m E : E will become 234(22) keV **
*^{208}Ac^m T : average 96Ik01=21(+28–8) 94Le05=25(+9–5) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{209}Hg	−8350#	200#				37	s	8	$9/2^+$#		98Zh22	T	β^-=100	
^{209}Tl	−13638	8				2.161	m	0.007	$(1/2^+)$	91	94Ar23	T	β^-=100	
^{209}Pb	−17614.4	1.8				3.253	h	0.014	$9/2^+$	91			β^-=100	
^{209}Bi	−18258.5	1.4				19	Ey	2	$9/2^-$	91	03De11	TD	IS=100.; α=100	
^{209}Po	−16365.9	1.8				102	y	5	$1/2^-$	91			α≈100; β^+=0.48 4	
^{209}At	−12880	7				5.41	h	0.05	$9/2^-$	91			β^+=95.9 5; α=4.1 5	
^{209}Rn	−8929	20				28.5	m	1.0	$5/2^-$	91			β^+=83 2; α=17 2	
^{209}Rn^m	−7755	20	1173.98	0.13		13.4	μs		$13/2^+$					
^{209}Fr	−3769	15				50.0	s	0.3	$9/2^-$	91			α=89 3; β^+=11 3	
^{209}Ra	1850	50				4.6	s	0.2	$5/2^-$	91			α≈90; β^+≈10	
^{209}Ac	8840	50				92	ms	11	$(9/2^-)$	91	00He17	T	α=?; β^+=1#	*
^{209}Th	16500	100				7	ms	5	$5/2^-$#	97	96Ik01	TD	α=?; β^+ ?	

*^{209}Ac T : average 00He17=98(+59–27) 96Ik01=82(+18–13) 94Le05=91(+21–14) **
*^{209}Ac T : and 68Va04=100(50) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{210}Hg	−5110#	300#				10#	m	(>300 ns)	0^+	03	98Pf02	I	β^- ?	
^{210}Tl	−9246	12				1.30	m	0.03	5^+#	03			β^-=100; β^-n=0.009 6	
^{210}Pb	−14728.3	1.5				22.20	y	0.22	0^+	03			β^-=100; α=1.9e–6 4	
^{210}Pb^m	−13450	5	1278	5		201	ns	17	8^+	03			IT=100	
^{210}Bi	−14791.8	1.4				5.012	d	0.005	1^-	03			β^-=100; α=13.2e–5 10	
^{210}Bi^m	−14520.5	1.4	271.31	0.11		3.04	My	0.06	9^-	03			α=100	
^{210}Bi^n	−14358.3	1.4	433.49	0.10		57.5	ns	10	7^-	03			IT=100	
^{210}Po	−15953.1	1.2				138.376	d	0.002	0^+	03			α=100	
^{210}Po^m	−14396.1	1.2	1556.96	0.03		98.9	ns	2.5	8^+	03			IT=100	
^{210}At	−11972	8				8.1	h	0.4	$(5)^+$	03			$\beta^+\approx$100; α=0.175 20	
^{210}At^m	−9422	8	2549.6	0.2		482	μs	6	$(15)^-$	03			IT=100	
^{210}At^n	−7944	8	4027.7	0.2		5.66	μs	0.07	$(19)^+$	03			IT=100	
^{210}At^p	−5013	8	6959.3	0.6		98	ns	2	(26^-)	03			IT=100	
^{210}Rn	−9598	9				2.4	h	0.1	0^+	03			α=96 1; β^+ ?	
^{210}Rn^m	−7908	17	1690	15		644	ns	40	8^+#	03			IT ?	*
^{210}Rn^n	−5761	17	3837	15		1.06	μs	0.05	$(17)^-$	03			IT=100	
^{210}Rn^p	−3105	17	6493	15		1.04	μs	0.07	$(22)^+$	03			IT=100	
^{210}Fr	−3346	22				3.18	m	0.06	6^+	03			α=60 30; β^+=40 30	
^{210}Ra	461	15				3.7	s	0.2	0^+	03			α=?; β^+=4#	
^{210}Ra^m	2260	200	1800	200		2.24	μs		(8^+)	03	98Le.A	EJ		
^{210}Ac	8790	60				350	ms	40	7^+#	03	00He17	T	α=?; β^+=9#	*
^{210}Th	14043	25				17	ms	11	0^+	03			α=?; β^+=1#	

*^{210}Rn^m E : ENSDF2003: less than 50 keV above 1664.6 level **
*^{210}Ac T : average 00He17=335(+64–46) 68Va04=350(50) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{211}Tl	−6080#	200#				1#	m	(>300 ns)	$1/2^+$#		98Pf02	I	β^- ?	
^{211}Pb	−10491.4	2.7				36.1	m	0.2	$9/2^+$	91			β^-=100	
^{211}Bi	−11858	6				2.14	m	0.02	$9/2^-$	91			$\alpha\approx$100; β^-=0.276 4	
^{211}Bi^m	−10631	6	1227.2	0.3		70	ns	5	$(21/2^-)$	91			IT=100	
^{211}Bi^n	−10601	12	1257	10		1.4	μs	0.3	$(25/2^-)$	91	98Pf02	T	IT=100	
^{211}Po	−12432.5	1.3				516	ms	3	$9/2^+$	91			α=100	
^{211}Po^m	−10970	5	1462	5	AD	25.2	s	0.6	$(25/2^+)$	91			$\alpha\approx$100; IT=0.016 4	
^{211}Po^n	−10298	5	2135	5		0.25	μs	0.07	$(31/2^-)$		98Fo04	ETJ	IT$\approx$100; α ?	
^{211}Po^p	−7559	5	4874	5		2	μs	1	$(43/2^+)$		98Fo04	ETJ	IT$\approx$100; α ?	
^{211}At	−11647.1	2.8				7.214	h	0.007	$9/2^-$	96			ε=58.20 8; α=41.80 8	
^{211}Rn	−8756	7				14.6	h	0.2	$1/2^-$	96			β^+=72.6 17; α=27.4 17	
^{211}Fr	−4158	21				3.10	m	0.02	$9/2^-$	91			α>80; β^+<20	
^{211}Ra	836	26				13	s	2	$5/2^{(-)}$	91			α>93; β^+<7	
^{211}Ac	7200	70				213	ms	25	$9/2^-$#	91	00He17	T	$\alpha\approx$100; β^+<0.2	*
^{211}Th	13910	70				48	ms	20	$5/2^-$#	96	95Uu01	T	α=?; β^+=0.5#	

*^{211}Ac T : average 00He17=200(29) 68Va04=250(50) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{212}Tl	−1650#	300#				30#	s	(>300 ns)	5^+#		98Pf02	I	β^- ?	
^{212}Pb	−7547.4	2.2				10.64	h	0.01	0^+	92			β^-=100	
^{212}Pb^m	−6212	10	1335	10		5	μs	1	(8^+)	92	98Pf02	T	IT=100	
^{212}Bi	−8117.3	2.0				60.55	m	0.06	$1^{(-)}$	92	89Ha.A	D	β^-=64.06 6; α=35.94 6; . . .	*
^{212}Bi^m	−7870	30	250	30	AD	25.0	m	0.2	(9^-)	92			α=67 1; β^-=33 1; $\beta^-\alpha$=30 1	
^{212}Bi^n	−5920#	200#	2200#	200#		7.0	m	0.3	> 15	92			$\beta^-\approx$100; IT ?	*
^{212}Po	−10369.4	1.2				299	ns	2	0^+	92			α=100	
^{212}Po^m	−7459	12	2911	12	AD	45.1	s	0.6	(18^+)	92			$\alpha\approx$100; IT=0.07 2	
^{212}At	−8621	7				314	ms	2	(1^-)	92			$\alpha\approx$100; β^+<0.03; β^-<2e–6	
^{212}At^m	−8395	6	226	9	AD	119	ms	3	(9^-)	92			α>99; IT<1	
^{212}At^n	−3849	8	4772	3		152	μs	5	(25^-)		98By01	ETJ	IT=100	
^{212}Rn	−8660	3				23.9	m	1.2	0^+	92			α=100; 2β^+ ?	
^{212}Fr	−3538	26				20.0	m	0.6	5^+	92			β^+=57 2; α=43 2	
^{212}Ra	−191	11				13.0	s	0.2	0^+	92			α=?; β^+=15#	
^{212}Ra^m	1767	11	1958.4	0.5		10.9	μs	0.4	$(8)^+$	92			IT=100	

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
. . . *A*-group continued . . .														
^{212}Ac	7280	70				920	ms	50	6^+#	92	00He17	T	α=?; β^+=3#	*
^{212}Th	12091	18				36	ms	15	0^+	92			$\alpha\approx$100; β^+=0.3#	
^{212}Pa	21610	70				8	ms	5	7^+#		97Mi03	TD	α=100	
*^{212}Bi	D : . . . ; $\beta^-\alpha$=0.014													**
*^{212}Bi^n	E : 1910 keV, if 100% β^- decay goes to 2922 level in ^{212}Po, and if log ft for													**
*^{212}Bi^n	E : this transition is 5.1 (see ENSDF), or higher													**
*^{212}Ac	T : average 00He17=880(110) 68Va04=930(50)													**
*^{212}Ac	J : ENSDF proposes to assign 7^+, if the observed α feeds the ^{208}Fr 7^+ ground-state													**
^{213}Pb	−3184	8				10.2	m	0.3	$(9/2^+)$	92			β^-=100	
^{213}Bi	−5231	5				45.59	m	0.06	$9/2^-$	92			β^-=97.91 3; α=2.09 3	
^{213}Po	−6653	3				4.2	μs	0.8	$9/2^+$	92			α=100	
^{213}At	−6579	5				125	ns	6	$9/2^-$	92			α=100	
^{213}Rn	−5698	6				19.5	ms	0.1	$(9/2^+)$	92	00He17	T	α=100	*
^{213}Fr	−3550	8				34.6	s	0.3	$9/2^-$	92			α=99.45 3; β^+=0.55 3	
^{213}Ra	358	20				2.74	m	0.06	$1/2^-$	92			α=80 5; β^+ ?	
^{213}Ra^m	2127	21	1769	6	AD	2.1	ms	0.1	$17/2^-$#	92	76Ra37	J	IT$\approx$99; $\alpha\approx$1	*
^{213}Ac	6150	50				731	ms	17	$9/2^-$#	92	00He17	T	α=?; β^+ ?	
^{213}Th	12120	70				140	ms	25	$5/2^-$#	92			α=?; β^+ ?	
^{213}Pa	19660	70				7	ms	3	$9/2^-$#	97	95Ni05	TD	α=100	
*^{213}Rn	T : in same paper 18.0(0.4) 19.0(0.5), not used. Other 70Va13=25.0(0.2) at													**
*^{213}Rn	T : variance, not used													**
*^{213}Ra^m	E : derived from difference in α decay energy in the AME evaluation.													**
*^{213}Ra^m	E : ENSDF evaluation: less than 10 keV above 1769.7 level, thus 1775(3) keV													**
*^{213}Ra^m	J : 17/2$^-$ or 13/2$^+$ as proposed by 76Ra37													**
^{214}Pb	−181.3	2.4				26.8	m	0.9	0^+	95			β^-=100	
^{214}Bi	−1200	11				19.9	m	0.4	1^-	95	89Ha.A	D	$\beta^-\approx$100; α=0.021 1; $\beta^-\alpha$=0.003	
^{214}Po	−4469.9	1.5				164.3	μs	2.0	0^+	95			α=100	
^{214}At	−3380	4				558	ns	10	1^-	95			α=100	
^{214}At^m	−3320	8	59	9	AD	268	ns							
^{214}At^n	−3146	5	234	6	AD	760	ns		9^-					
^{214}Rn	−4320	9				270	ns	20	0^+	95			α=100; 2β^+ ?	
^{214}Rn^m	−2695	9	1625.1	0.5		6.5	ns	3.0	8^+					
^{214}Fr	−958	9				5.0	ms	0.2	(1^-)	95			α=100	
^{214}Fr^m	−835	9	123	6	AD	3.35	ms	0.05	(8^-)	95			α=100	
^{214}Ra	101	9				2.46	s	0.03	0^+	95			$\alpha\approx$100; β^+=0.059 4	
^{214}Ac	6429	22				8.2	s	0.2	5^+#	95			$\alpha\geq$89 3; $\beta^+\leq$11 3	
^{214}Th	10712	17				100	ms	25	0^+	95			$\alpha\approx$100; β^+=0.1#	
^{214}Pa	19490	80				17	ms	3		95	95Ni05	D	α=100	
^{215}Pb	4480#	410#				36	s	1	$5/2^+$#		96Ry.B	T	β^-=100	*
^{215}Bi	1649	15				7.6	m	0.2	$(9/2^-)$	01			β^-=100	
^{215}Bi^m	2997	15	1347.5	2.5		36.4	m	2.5	$(25/2^-)$	01	02Fr.B	D	IT=?; β^-=?	*
^{215}Po	−540.3	2.5				1.781	ms	0.004	$9/2^+$	01			α=100; β^-=2.3e–4 2	
^{215}At	−1255	7				100	μs	20	$9/2^-$	01			α=100	
^{215}Rn	−1169	8				2.30	μs	0.10	$9/2^+$	01			α=100	
^{215}Fr	318	7				86	ns	5	$9/2^-$	01			α=100	
^{215}Ra	2534	8				1.55	ms	0.07	$9/2^+$#	01			α=100	
^{215}Ra^m	4412	8	1877.8	0.5		7.1	μs	0.2	$(25/2^+)$	01			IT=100	
^{215}Ra^n	4781	8	2246.9	0.5		1.39	μs	0.07	$(29/2^-)$	01			IT=100	
^{215}Ac	6012	21				170	ms	10	$9/2^-$	01			$\alpha\approx$100; β^+=0.09 2	
^{215}Th	10927	27				1.2	s	0.2	$(1/2^-)$	01			α=100	
^{215}Pa	17870	90				14	ms	2	$9/2^-$#	01			α=100	
*^{215}Pb	T : other preliminary result 02Fr.B=147(12) s													**
*^{215}Bi^m	T : other preliminary result 02Fr.B=36.9(0.6) s													**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{216}Bi	5874	11				2.17	m	0.05	1^-#	97	96Ry.B	T	β^-=100	*
^{216}Po	1783.8	2.2				145	ms	2	0^+	97			α=100; 2β^- ?	
^{216}At	2257	4				300	μs	30	$1^{(-)}$	97			$\alpha\approx$100; β^-<0.006; ε<3e–7	
^{216}At^m	2670	6	413	5		100#	μs		(9^-)	97			α=100	
^{216}Rn	256	7				45	μs	5	0^+	97			α=100	
^{216}Fr	2979	14				700	ns	20	(1^-)	97			α=100; β^+<2e–7#	
^{216}Ra	3291	9				182	ns	10	0^+	97			α=100; ε<1e–8	
^{216}Ac	8123	27				440	μs	16	(1^-)	97	00He17	T	α=100; β^+=7e–5#	
^{216}Ac^m	8166	26	44	7	AD	443	μs	7	(9^-)	97	00He17	T	α=100; β^+=7e–5#	
^{216}Th	10304	13				26.8	ms	0.3	0^+	97	01Ha46	T	$\alpha\approx$100; β^+=0.006#	*
^{216}Th^m	12346	16	2042	13	AD	137	μs	4	(8^+)	97	01Ha46	TJD	IT=94 4; α=?	*
^{216}Th^n	12941	24	2637	20		615	ns	55	(11^-)	97	01Ha46	TJ	IT=100	
^{216}Pa	17800	70				105	ms	12		97	96An21	T	α=?; β^+=2#	*

*^{216}Bi T : also 90Ru02=3.6(0.4) outweighed, not used **
*^{216}Th T : average 01Ha46=25.4(0.8) 00He17=27.0(0.3); other 68Va18=28(2) outweighed **
*^{216}Th^m T : average 01Ha46=128(8) 00He17=140(5) **
*^{216}Pa T : not updated in 00He17: "could not be determined satisfactorily" **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{217}Bi	8820#	200#				97	s	3	$9/2^-$#		96Ry.B	T	β^-=100	
^{217}Po	5901	7				1.47	s	0.05	$5/2^+$#	91	96Ry.B	T	α>95; β^-<5	
^{217}At	4396	5				32.3	ms	0.4	$9/2^-$	91	97Ch53	D	$\alpha\approx$100; β^-=0.008 2	*
^{217}Rn	3659	4				540	μs	50	$9/2^+$	91			α=100	
^{217}Fr	4315	7				16.8	μs	1.9	$9/2^-$	94	90An19	T	α=100	*
^{217}Ra	5887	9				1.63	μs	0.17	$(9/2^+)$	91	90An19	T	α=100	*
^{217}Ac	8707	13				69	ns	4	$9/2^-$	91			α=?; $\beta^+\leq$2	
^{217}Ac^m	10719	19	2012	20	AD	740	ns	40	$(29/2)^+$	91			IT=95.7 10; α=4.3 10	
^{217}Th	12216	21				240	μs	5	$(9/2^+)$	91	02He29	T	α=100	*
^{217}Pa	17070	50				3.48	ms	0.09	$9/2^-$#	91	02He29	T	α=100	*
^{217}Pa^m	18930	50	1860	7	AD	1.08	ms	0.03	$29/2^+$#	91	02He29	TD	α=73 4; IT ?	
^{217}U	22700	90				26	ms	14	$1/2^-$#		00Ma65	TD	α=?	

*^{217}At D : average β^- 97Ch53=0.0067(24) 69Le.A=0.012(4) **
*^{217}Fr T : average 90An19=16(2) 70Bo13=22(5) **
*^{217}Ra T : average 90An19=1.7(0.3) 70Bo13=1.6(0.2) **
*^{217}Th T : average 02He29=237(2) 00He17=247(3) with Birge ratio B=2.8 **
*^{217}Pa T : average 02He29=3.8(0.2) 00He17=3.4(0.1) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{218}Bi	13340#	360#				33	s	1	1^-#		02Fr.B	TD	β^-=100	
^{218}Po	8358.3	2.4				3.10	m	0.01	0^+	96			$\alpha\approx$100; β^-=0.020 2	
^{218}At	8099	12				1.5	s	0.3	1^-#	96			$\alpha\approx$100; β^-=0.1	
^{218}Rn	5217.5	2.4				35	ms	5	0^+	96			α=100	
^{218}Fr	7059	5				1.0	ms	0.6	1^-	96			α=100	
^{218}Fr^m	7146	6	86	4	AD	22.0	ms	0.5		96			$\alpha\approx$100; IT ?	
^{218}Fr^p	7260#	150#	200#	150#					high					
^{218}Ra	6651	11				25.6	μs	1.1	0^+	96			α=100; 2β^+ ?	
^{218}Ac	10840	50				1.08	μs	0.09	1^-#	96			α=100	
^{218}Ac^m	10990#	70#	150#	50#		32	ns	9	(9^-)		94De04	ET		*
^{218}Ac^n	11420#	70#	584#	50#		103	ns	11	(11^+)	96				*
^{218}Th	12374	13				109	ns	13	0^+	96			α=100	
^{218}Pa	18669	25				113	μs	10		96	00He17	T	α=100	*
^{218}U	21920	30				6	ms	5	0^+	96			α=100	

*^{218}Ac^m E : at least 122.5 in 94De04 **
*^{218}Ac^n E : 384.5(0.2) keV above ^{218}Ac^m, from ENSDF **
*^{218}Pa T : supersedes 96An21=110(20) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{219}Po	12800#	360#				2#	m	(>300 ns)	$7/2^+$#		98Pf02	I	β^- ?; α ?	
^{219}At	10397	4				56	s	3	$5/2^-$#	01			α≈97; β^-≈3	
^{219}Rn	8830.8	2.5				3.96	s	0.01	$5/2^+$	01			α=100	
^{219}Fr	8618	7				20	ms	2	$9/2^-$	01			α=100	
^{219}Ra	9394	8				10	ms	3	$(7/2)^+$	01			α=100	
^{219}Ac	11570	50				11.8	μs	1.5	$9/2^-$	01			α=100; β^+=1e–6#	
^{219}Th	14470	50				1.05	μs	0.03	$9/2^+$#	01			α=100; β^+=1e–7#	
^{219}Pa	18520	50				53	ns	10	$9/2^-$	01			α=100; β^+=5e–9#	
^{219}U	23210	60				55	μs	25	$9/2^+$#	01			α=100; β^+=1.4e–5#	
^{220}Po	15470#	360#				40#	s	(>300 ns)	0^+		98Pf02	I	β^- ?	
^{220}At	14350	50				3.71	m	0.04	$3^{(-\#)}$	97			β^-=92 2; α=8 2	
^{220}Rn	10613.4	2.2				55.6	s	0.1	0^+	97			α=100; 2β^- ?	
^{220}Fr	11483	4				27.4	s	0.3	1^+	97			α≈100; β^-=0.35 5	
^{220}Ra	10273	9				17.9	ms	1.4	0^+	97	00He17	T	α=100	*
^{220}Ac	13752	15				26.36	ms	0.19	(3^-)	97	90An19	T	α=100; β^+=5e–4#	*
^{220}Th	14669	22				9.7	μs	0.6	0^+	97			α=100; ε=2e–7#	
^{220}Pa	20380	60				780	ns	160	1^-#	97			α=100; β^+=3e–7#	
^{220}U	23030#	200#				60#	ns		0^+				α ?; β^+ ?	
*^{220}Ra	T : average 00He17=18(2) 90An19=17(2) 61Ru06=23(5)													**
*^{220}Ac	T : average 90An19=26.4(0.2) 70Bo13=26.1(0.5)													**
^{221}At	16810#	200#				2.3	m	0.2	$3/2^-$#	90			β^-=100	
^{221}Rn	14472	6				25	m	2	$7/2^{(+)}$	90			β^-=78 1; α=22 1	
^{221}Fr	13278	5				4.9	m	0.2	$5/2^-$	90	97Ch53	D	α≈100; β^-=0.0048 15; ...	*
^{221}Ra	12964	5				28	s	2	$5/2^+$	90	94Bo28	D	α=100; ^{14}C=1.2e–10 9	
^{221}Ac	14520	50				52	ms	2	$9/2^-$#	90			α=100	
^{221}Th	16938	9				1.68	ms	0.06	$(7/2^+)$	90			α=100	*
^{221}Pa	20380	50				5.9	μs	1.7	$9/2^-$	90			α=100	
^{221}U	24590#	100#				700#	ns		$9/2^+$#				α ?; β^+ ?	
*^{221}Fr	D : ... ; ^{14}C=8.8e–11 11													**
*^{221}Fr	D : β^- intensity is from 97Ch53; ^{14}C intensity is from 94Bo28													**
*^{221}Th	T : also 00He17=2.0(+0.3–0.2)													**
^{222}At	20800#	300#				54	s	10		96			β^-=100	
^{222}Rn	16373.6	2.4				3.8235	d	0.0003	0^+	96			α=100	
^{222}Fr	16349	21				14.2	m	0.3	2^-	96			β^-=100	
^{222}Ra	14321	5				38.0	s	0.5	0^+	96			α=100; ^{14}C=3.0e–8 10	
^{222}Ac	16621	5			*	5.0	s	0.5	1^-	96			α=99 1; β^+=1 1	
^{222}Ac^m	16820#	150#	200#	150#	*	1.05	m	0.07	high	96			α=?; IT≤10; β^+=1.4 4	*
^{222}Th	17203	12				2.05	ms	0.07	0^+	96	00He17	T	α=100; ε<1.3e–8#	*
^{222}Pa	22120#	70#				3.2	ms	0.3		96	95Ni.A	T	α=100	*
^{222}U	24300#	100#				1.4	μs	0.7	0^+	96			α=100; β^+<1e–6#	
*^{222}Ac^m	D : derived from 0.7% < β^+ < 2%, in ENSDF													**
*^{222}Th	T : average 00He17=2.0(0.1) 99Gr28=2.1(0.1)													**
*^{222}Pa	T : average 95Ni.A=3.3(0.3) 79Sc09=2.9(+0.6–0.4)													**
*^{222}Pa	T : 70Bo13=5.7(0.5) at variance, not used													**
^{223}At	23460#	400#				50	s	7	$3/2^-$#	01			β^-≈100; α=0.008#	
^{223}Rn	20300#	300#				24.3	m	0.4	$7/2$	01			β^-=100; α=0.0004#	
^{223}Fr	18383.8	2.4				22.00	m	0.07	$3/2^{(-)}$	01			β^-≈100; α=0.006	
^{223}Ra	17234.7	2.5				11.43	d	0.05	$3/2^+$	01			α=100; ^{14}C=8.9e–8 4	
^{223}Ac	17826	7				2.10	m	0.05	$(5/2^-)$	01			α=99; ε=1	
^{223}Th	19386	9				600	ms	20	$(5/2)^+$	01			α=100	
^{223}Pa	22320	70				5.1	ms	0.3	$9/2^-$#	01	99Ho28	T	α=100; β^+<0.001#	*
^{223}U	25840	70				21	μs	8	$7/2^+$#	01			α≈100; β^+=0.2#	
*^{223}Pa	T : average 99Ho28=4.9(0.4) 95Ni.A=5.0(1.0) 70Bo13=6.5(1.0)													**

Nuclide	Mass excess (keV)		Excitation energy(keV)	Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{224}Rn	22440#	300#		107	m	3	0^{+}	97			β^{-}=100	
^{224}Fr	21660	50		3.33	m	0.10	1^{-}	97			β^{-}=100	
^{224}Ra	18827.2	2.2		3.66	d	0.04	0^{+}	97			α=100; ^{14}C=4.0e–9 12	
^{224}Ac	20235	4		2.78	h	0.17	0^{-}	97			β^{+}=90.6 17; α=9.4 17; β^{-}<1.6#	
^{224}Th	19996	11		1.05	s	0.02	0^{+}	97			α=100; 2β^{+} ?	
^{224}Pa	23870	16		844	ms	19	5^{-}#	97	96Li05	T	$\alpha\approx$100; β^{+}=0.1#	*
^{224}U	25714	25		940	μs	270	0^{+}	97	92To02	T	α=100; β^{+}<1.2e–4#	*
*^{224}Pa	T : average 96Li05=790(60) 96Wi.A=850(20)											**
*^{224}U	T : average 92To02=1000(400) 91An10=700(+500–200)											**
^{225}Rn	26490#	300#		4.66	m	0.04	$7/2^{-}$	90	97Bu03	T	β^{-}=100	
^{225}Fr	23810	30		4.0	m	0.2	$3/2^{-}$	90			β^{-}=100	
^{225}Ra	21994.0	3.0		14.9	d	0.2	$1/2^{+}$	90			β^{-}=100	
^{225}Ac	21638	5		10.0	d	0.1	$(3/2^{-})$	90	93Bo26	D	α=100; ^{14}C=6.0e–10 13	
^{225}Th	22310	5		8.72	m	0.04	$(3/2)^{+}$	90			$\alpha\approx$90; $\varepsilon\approx$10	
^{225}Pa	24340	70		1.7	s	0.2	$5/2^{-}$#	90			α=100	
^{225}U	27377	12		61	ms	4	$5/2^{+}$#	90	00He17	T	α=100	*
^{225}Np	31590	70		3#	ms	(>2 μs)	$9/2^{-}$#	97	94Ye08	ID	α=100	
*^{225}U	T : 00He17=59(+5–2); others 94An02=68(+45–20) 92To02=95(15) and											**
*^{225}U	T : 89He13=80(+40–10) outweighed, not used											**
^{226}Rn	28770#	400#		7.4	m	0.1	0^{+}	96			β^{-}=100	
^{226}Fr	27370	100		49	s	1	1^{-}	96			β^{-}=100	
^{226}Ra	23669.1	2.3		1.600	ky	0.007	0^{+}	96	90We01	D	α=100; ^{14}C=2.6e–9 6; 2β^{-} ?	*
^{226}Ac	24310	3		29.37	h	0.12	$(1)^{(-\#)}$	96			β^{-}=83 3; ε=17 3; α=0.006 2	
^{226}Th	23197	5		30.57	m	0.10	0^{+}	96	01Bo11	D	α=100; ^{18}O<3.2e–12	
^{226}Pa	26033	11		1.8	m	0.2		96			α=74 5; β^{+}=26 5	
^{226}U	27329	13		269	ms	6	0^{+}	96	01Ca.B	T	α=100	*
^{226}Np	32740#	90#		35	ms	10		96			α=100; β^{+}=0.003#	
*^{226}Ra	D : ^{14}C: average 90We01=2.3(0.8) 86Ba26=2.9(1.0) 85Ho21=3.2(1.6)											**
*^{226}U	T : average 01Ca.B=258(13) 00He17=281(9) 99Gr28=260(10)											**
^{227}Rn	32980#	420#		20.8	s	0.7	$5/2^{(+\#)}$	01	97Ku20	J	β^{-}=100	
^{227}Fr	29650	100		2.47	m	0.03	$1/2^{+}$	01			β^{-}=100	
^{227}Ra	27179.0	2.4		42.2	m	0.5	$3/2^{+}$	01			β^{-}=100	
^{227}Ac	25850.9	2.4		21.772	y	0.003	$3/2^{-}$	01			β^{-}=98.62 36; α=1.38 36	
^{227}Th	25806.2	2.5		18.68	d	0.09	$1/2^{+}$	01			α=100	
^{227}Pa	26832	7		38.3	m	0.3	$(5/2^{-})$	01			α=85 2; ε=15 2	
^{227}U	29022	17		1.1	m	0.1	$(3/2^{+})$	01			α=100; β^{+}<0.001#	
^{227}Np	32560	70		510	ms	60	$5/2^{-}$#	01			$\alpha\approx$100; β^{+}=0.05#	
^{228}Rn	35380#	410#		65	s	2	0^{+}	97			β^{-}=100	
^{228}Fr	33280#	200#		38	s	1	2^{-}	97			β^{-}=100	
^{228}Ra	28941.8	2.4		5.75	y	0.03	0^{+}	97			β^{-}=100	
^{228}Ac	28896.0	2.5		6.15	h	0.02	3^{+}	97			β^{-}=100	
^{228}Th	26772.2	2.2		1.9116	y	0.0016	0^{+}	97			α=100; ^{20}O=1.13e–11 22	
^{228}Pa	28924	4		22	h	1	3^{+}	97			β^{+}=98.0 2; α=2.0 2	
^{228}U	29225	15		9.1	m	0.2	0^{+}	97			α>95; ε<5	
^{228}Np	33700#	200#		61.4	s	1.4		97	94Kr13	D	ε=60 7; α=40 7; β^{+}SF=0.012 6	*
^{228}Pu	36090	30		10#	ms	(>2 μs)	0^{+}	97	94An02	ID	$\alpha\approx$100; β^{+}=0.1#	
*^{228}Np	D : β^{+}SF=0.020(9)% defined by 94Kr13 relative to ε, thus 0.012(6)% of total											**

Nuclide	Mass excess (keV)		Excitation energy(keV)		Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{229}Fr	35820	40			50.2	s	0.4	$1/2^+$#	90	92Bo05	T	β^-=100	
^{229}Ra	32563	19			4.0	m	0.2	$5/2^{(+)}$	90			β^-=100	
^{229}Ac	30750	30			62.7	m	0.5	$(3/2^+)$	90			β^-=100	
^{229}Th	29586.5	2.8			7.34	ky	0.16	$5/2^+$	90			α=100	
^{229}Th^m	29586.5	2.8	0.0035	0.0010	70	h	50	$3/2^+$		94He08	TEJ	IT ?	*
^{229}Pa	29898.0	2.7			1.50	d	0.05	$(5/2^+)$	90			$\varepsilon\approx$100; α=0.48 5	
^{229}Pa^m	29909.6	2.7	11.6	0.3	420	ns	30	$3/2^-$		98Le15	EJD	IT=100	
^{229}U	31211	6			58	m	3	$(3/2^+)$	90			$\beta^+\approx$80; $\alpha\approx$20	
^{229}Np	33780	90			4.0	m	0.2	$5/2^+$#	90			$\alpha>$50; $\beta^+<$50	
^{229}Np^p	33850#	100#	70#	50#				$5/2^-$#					
^{229}Pu	37400	50			120	s	50	$3/2^+$#	97	01Ca.B	TD	α=100	
*^{229}Th^m	D : ultraviolet γ-ray emission assigned by 97Ir02 and 98Ri03 to IT decay is												**
*^{229}Th^m	D : proved by 99Sh12 to be due to N_2 discharge emission. 99Ut01 sees												**
*^{229}Th^m	D : no UV in vacuo.												**
^{230}Fr	39600#	450#			19.1	s	0.5		93			β^-=100	
^{230}Ra	34518	12			93	m	2	0^+	93			β^-=100	
^{230}Ac	33810	300			122	s	3	(1^+)	94	01Yu03	D	β^-=100; β^-SF=1.19e–6 40	
^{230}Th	30864.0	1.8			75.38	ky	0.30	0^+	93			α=100; SF<5e–11; ...	*
^{230}Pa	32175	3			17.4	d	0.5	(2^-)	93			β^+=91.6 13; β^-=8.4 13; ...	*
^{230}U	31615	5			20.8	d		0^+	93	01Bo11	D	α=100; 22Ne=4.8e–12 20; ...	*
^{230}Np	35240	50			4.6	m	0.3		93			$\beta^+\leq$97; $\alpha\geq$3	
^{230}Np^p	35540#	210#	300#	200#				*am*					
^{230}Pu	36934	15			1.70	m	0.17	0^+	93	01Ca.B	T	α=?; β^+ ?	*
*^{230}Th	D : ... ; ^{24}Ne=5.6e–11 10												**
*^{230}Pa	D : ... ; α=0.0032 1												**
*^{230}U	D : ... ; SF<1.4e–10#; 2β^+ ?												**
*^{230}Pu	T : also 90An22=154(66)s outweighed, not used												**
^{231}Fr	42330#	470#			17.6	s	0.6	$1/2^+$#	01			β^-=100	
^{231}Ra	38400#	300#			103	s	3	$(5/2^+)$	01			β^-=100	
^{231}Ra^m	38470#	300#	66.21	0.09	53	μs		$(1/2^+)$	01			IT=100	
^{231}Ac	35920	100			7.5	m	0.1	$(1/2^+)$	01			β^-=100	
^{231}Th	33817.3	1.8			25.52	h	0.01	$5/2^+$	01			β^-=100; α=4e–11#	
^{231}Pa	33425.7	2.3			32.76	ky	0.11	$3/2^-$	01			α=100; SF$\leq$3e–10; ...	*
^{231}U	33807	3			4.2	d	0.1	$(5/2)^{(+\#)}$	01			$\varepsilon\approx$100; α=0.004 1	
^{231}Np	35630	50			48.8	m	0.2	$(5/2)^{(+\#)}$	01			β^+=98 1; α=2 1	
^{231}Np^p	35690#	60#	60#	40#				$5/2^-$#					
^{231}Pu	38285	26			8.6	m	0.5	$3/2^+$#	01	99La14	D	β^+=87 5; α=13 5	
^{231}Am	42440#	300#			30#	s						β^+ ?; α ?	
*^{231}Pa	D : ... ; ^{24}Ne=13.4e–10 17; ^{23}F=9.9e–13												**
^{232}Fr	46360#	640#			5	s	1		97	90Me13	T	β^-=100	
^{232}Ra	40650#	280#			250	s	50	0^+	91			β^-=100	
^{232}Ac	39150	100			119	s	5	(1^+)	91			β^-=100	
^{232}Th	35448.3	2.0			14.05	Gy	0.06	0^+	91	95Bo18	D	IS=100.; α=100; SF=11e–10 3; ...	*
^{232}Pa	35948	8			1.31	d	0.02	(2^-)	91			$\beta^-\approx$100; ε=0.003 1	
^{232}U	34610.7	2.2			68.9	y	0.4	0^+	91	90Bo16	D	α=100; ^{24}Ne=8.9e–10 7; ...	*
^{232}Np	37360#	100#			14.7	m	0.3	(4^+)	91			$\beta^+\approx$100; $\alpha\approx$0.003	
^{232}Pu	38366	18			33.7	m	0.5	0^+	91	ABBW	D	ε=?; α=11#	*
^{232}Am	43400#	300#			1.31	m	0.04		91			β^+=?; α=2#; β^+SF=0.069 10	
*^{232}Th	D : ... ; ^{24}Ne+^{26}Ne<2.78e–10; 2β^- ?												**
*^{232}U	D : ... ; ^{28}Mg<5e–12; SF<1e–12												**
*^{232}U	D : ^{24}Ne: average, as adopted by 91Bo20, of 2 results from their group												**
*^{232}Pu	T : average 00La25=33.1(0.8) 73Ja06=34.1(0.7)												**
*^{232}Pu	D : derived from 1.6%# $<\alpha<$ 20%#, in ENSDF												**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{233}Ra	44770#	470#					30	s	5	$1/2^+$#	97	90Me13	T	β^-=100	
^{233}Ac	41500#	300#					145	s	10	$(1/2^+)$	90			β^-=100	
^{233}Th	38733.2	2.0					22.3	m	0.1	$1/2^+$	90			β^-=100	
^{233}Pa	37490.1	2.2					26.967	d	0.002	$3/2^-$	90			β^-=100	
^{233}U	36920.0	2.7					159.2	ky	0.2	$5/2^+$	96	91Pr02	D	α=100; SF<6e–9; ...	*
^{233}Np	37950	50					36.2	m	0.1	$(5/2^+)$	90			$\beta^+\approx$100; $\alpha\leq$0.001	
^{233}Np^p	38000#	60#	50#	30#						$(5/2^-)$	90				
^{233}Pu	40050	50					20.9	m	0.4	$5/2^+$#	90			$\beta^+\approx$100; α=0.12 5	
^{233}Am	43170#	100#					3.2	m	0.8			00Sa52	TD	β^+ ?; α>3	
^{233}Cm	47290	70					1#	m		$3/2^+$#		01Ca.B	D	α=?; β^+ ?	
*^{233}U	D : ... ; ^{24}Ne=7.2e–11 9; ^{28}Mg<1.3e–13														**
^{234}Ra	47230#	490#					30	s	10	0^+	94			β^-=100	
^{234}Ac	45100#	400#					44	s	7		94			β^-=100	
^{234}Th	40614	3					24.10	d	0.03	0^+	94			β^-=100	
^{234}Pa	40341	5					6.70	h	0.05	4^+	94	78Ga07	D	β^-=100; SF<3e–10	
^{234}Pa^m	40419	4	78	3			1.17	m	0.03	(0^-)	94	78Ga07	D	$\beta^-\approx$100; IT=0.16 4; SF<1e–10	
^{234}U	38146.6	1.8					245.5	ky	0.6	0^+	94			IS=0.0055 2; α=100; ...	*
^{234}U^m	39567.9	1.8	1421.32	0.10			33.5	μs	2.0	6^-					
^{234}Np	39956	9					4.4	d	0.1	(0^+)	94			β^+=100	
^{234}Pu	40350	7					8.8	h	0.1	0^+	94			$\varepsilon\approx$94; $\alpha\approx$6	
^{234}Am	44530#	210#					2.32	m	0.08		94	90Ha02	D	$\beta^+\approx$100; α=0.039 12; ...	*
^{234}Cm	46724	18					51	s	12	0^+		01Ca.B	TD	α=?; β^+=47#; SF=3	
*^{234}U	D : ... ; SF=1.73e–9 10; ^{28}Mg=1.4e–11 3; ^{24}Ne+^{26}Ne=9e–12 7														**
*^{234}Am	D : ... ; β^+SF=0.0066 18														**
^{235}Ac	47720#	360#					40#	s		$1/2^+$#				β^- ?	
^{235}Th	44260	50					7.2	m	0.1	$1/2^+$#	03			β^-=100	
^{235}Pa	42330	50					24.44	m	0.11	$(3/2^-)$	03			β^-=100	
^{235}U	40920.5	1.8					704	My	1	$7/2^-$	03			IS=0.7200 51; α=100; ...	*
^{235}U^m	40920.6	1.8	0.0765	0.0004			26	m		$1/2^+$	03			IT=100	
^{235}Np	41044.7	2.0					396.1	d	1.2	$5/2^+$	03			$\varepsilon\approx$100; α=0.00260 13	
^{235}Pu	42184	21					25.3	m	0.5	$(5/2^+)$	03			$\beta^+\approx$100; α=0.0028 7	
^{235}Am	44660#	120#					9.9	m	0.5	$5/2^-$#	03			$\beta^+\approx$100; α=0.40 5	
^{235}Cm	47910#	200#					5#	m		$5/2^+$#	03			β^+ ?; α ?	
^{235}Cm^p	47960#	210#	50#	50#						*am*					
^{235}Bk	52700#	400#					20#	s						β^+ ?; α ?	
*^{235}U	D : ... ; SF=7e–9 2; ^{20}Ne=8e–10 4; ^{25}Ne$\approx$8e–10; ^{28}Mg=8e–10														**
^{236}Ac	51510#	500#					2#	m						β^- ?	
^{236}Th	46450#	200#					37.5	m	0.2	0^+	91			β^-=100	
^{236}Pa	45350	200					9.1	m	0.1	$1^{(-)}$	91			β^-=100; β^-SF=6e–8 4	*
^{236}U	42446.3	1.8					23.42	My	0.03	0^+	91			α=100; SF=9.6e–8 6	*
^{236}U^m	45196	10	2750	10			115	ns		0^+					
^{236}Np	43380	50				*	154	ky	6	(6^-)	91			ε=87.3 5; β^-=12.5 5; α=0.16 4	
^{236}Np^m	43439	7	60	50		*	22.5	h	0.4	1	91			ε=52 1; β^-=48 1	
^{236}Np^p	43618	14	240	50	AD					3^-					
^{236}Pu	42902.7	2.2					2.858	y	0.008	0^+	91	90Og01	D	α=100; SF=1.36e–7 4; ...	*
^{236}Am	46180#	100#					30#	m			91			β^+ ?; α ?	
^{236}Cm	47890#	200#					10#	m		0^+	91			β^+ ?; α ?	
^{236}Bk	53400#	400#					1#	m						β^+ ?; α ?	
*^{236}Pa	D : β^-SF decay questioned by 90Ha02														**
*^{236}U	D : and Ne+Mg < 4e–10%, from 89Mi.A														**
*^{236}Pu	D : ... ; ^{28}Mg=2e–12; 2β^+ ?														**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{237}Th	50200#	360#				4.8	m	0.5	$5/2^+$#	97	00Xu02	T	β^-=100	*
^{237}Pa	47640	100				8.7	m	0.2	$(1/2^+)$	95			β^-=100	
^{237}U	45391.9	1.9				6.75	d	0.01	$1/2^+$	95			β^-=100	
^{237}Np	44873.3	1.8				2.144	My	0.007	$5/2^+$	95	89Pr.A	D	α=100; SF≤2e–10; ^{30}Mg<4e–12	*
^{237}Pu	45093.3	2.2				45.2	d	0.1	$7/2^-$	95			ε≈100; α=0.0042 4	
^{237}Pu^m	45238.8	2.2	145.544	0.010		180	ms	20	$1/2^+$	95			IT=100	
^{237}Am	46570#	60#				73.0	m	1.0	$5/2^{(-)}$	95			β^+≈100; α=0.025 3	
^{237}Cm	49280#	210#				20#	m		$5/2^+$#	95			β^+ ?; α ?	
^{237}Cm^p	49480#	260#	200#	150#					$7/2^-$					
^{237}Bk	53100#	220#				1#	m		$7/2^+$#				β^+ ?; α ?	
^{237}Bk^p	53170#	230#	70#	30#	Nm				$(3/2^-)$					
^{237}Cf	57820#	500#				2.1	s	0.3	$5/2^+$#	98	95La09	TD	α ?; SF≈10; β^+ ?	

*^{237}Th T : average 00Xu02=4.69(0.60) 93Yu03=5.0(0.9) **
*^{237}Np D : and cluster (Z=10-14) < 1.8e–12%, from 92Mo03 **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{238}Th	52630#	280#				9.4	m	2.0	0^+	02			β^-=100	
^{238}Pa	50770	60				2.27	m	0.09	3^-#	02	85Ba57	D	β^-=100; β^-SF<2.6e–6	
^{238}U	47308.9	1.9				4.468	Gy	0.003	0^+	02	91Tu02	D	IS=99.2745 106; α=100; . . .	*
^{238}U^m	49866.8	2.0	2557.9	0.5		280	ns	6	0^+	02			IT=?; SF=2.6 4; α<0.5	
^{238}Np	47456.3	1.8				2.117	d	0.002	2^+	02			β^-=100	
^{238}Np^m	49760#	200#	2300#	200#		112	ns	39		02			SF≈100; IT ?	
^{238}Pu	46164.7	1.8				87.7	y	0.1	0^+	02	89Wa10	D	α=100; SF=1.9e–7 1; . . .	*
^{238}Am	48420	50				98	m	2	1^+	02			β^+=100; α=1.0e–4 4	
^{238}Am^m	50920#	210#	2500#	200#		35	μs	10		02			SF≈100; IT ?	
^{238}Cm	49400	40				2.4	h	0.1	0^+	02			ε ?; α≤10	
^{238}Bk	54290#	290#				2.40	m	0.08		02	94Kr03	D	β^+≈100; α ?; β^+SF=0.048 2	
^{238}Bk^p	54490#	330#	200#	150#					*am*					
^{238}Cf	57200#	400#				21.1	ms	1.3	0^+	02	01Og08	TD	SF≈100; α≈0.2; β^+ ?	*

*^{238}U D : . . . ; SF=5.45e–5 7; 2β^-=2.2e–10 7 **
*^{238}U D : 2β^-=2.2(7)e–10% derived from 2β^- half-life T=2.0(0.6) Zy, in 91Tu02 **
*^{238}Pu D : . . . ; ^{32}Si≈1.4e–14; ^{28}Mg+^{30}Mg≈6e–15 **
*^{238}Cf T : average 01Og08=21.1(+1.9–1.7) 95La09=21(2) **

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{239}Pa	53340#	200#				1.8	h	0.5	$(3/2)^{(-\#)}$	03			β^-=100	
^{239}U	50573.9	1.9				23.45	m	0.02	$5/2^+$	03			β^-=100	
^{239}U^m	50594#	20#	20#	20#		> 250	ns		$(5/2^+)$	03			β^-=100	
^{239}U^n	50707.7	1.9	133.7990	0.0010		780	ns	40	$1/2^+$	03			IT=100	
^{239}Np	49312.4	2.1				2.356	d	0.003	$5/2^+$	03			β^-=100; α=5e–10#	
^{239}Pu	48589.9	1.8				24.11	ky	0.03	$1/2^+$	03			α=100; SF=3.1e–10 6	
^{239}Pu^m	48981.5	1.8	391.584	0.003		193	ns	4	$7/2^-$	03			IT=100	
^{239}Am	49392.0	2.4				11.9	h	0.1	$(5/2)^-$	03			ε≈100; α=0.010 1	
^{239}Am^m	51890	200	2500	200		163	ns	12	$(7/2^+)$	03			SF≈100; IT ?	
^{239}Cm	51190#	100#				2.9	h		$(7/2^-)$	03			β^+≈100; α<0.1	
^{239}Cm^p	51340#	140#	150#	100#					$1/2^+$					
^{239}Bk	54290#	230#				3#	m		$7/2^+$#	03			β^+ ?; α ?	
^{239}Bk^p	54330#	230#	41	11	AD				$(3/2^-)$					
^{239}Cf	58150#	210#				60	s	30	$5/2^+$#	03			α=?; β^+ ?	

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{240}Pa	56800#	300#				2#	m						β^- ?	
^{240}U	52715	5				14.1	h	0.1	0^+	96			β^-=100; α<1e–10	
^{240}Np	52315	15				* 61.9	m	0.2	(5^+)	96			β^-=100	
^{240}Np^m	52335	21	20	15		* 7.22	m	0.02	$1^{(+)}$	96	81Hs02	E	β^-≈100; IT=0.11 3	
^{240}Pu	50127.0	1.8				6.564	ky	0.011	0^+	01	89Pr.A	D	α=100; SF=5.7e–6 2; 34Si<1.3e–13	
^{240}Am	51512	14				50.8	h	0.3	(3^-)	96			β^+=100; α≈1.9e–4	
^{240}Cm	51725.4	2.3				27	d	1	0^+	96			α≈100; ε<0.5; SF=3.9e–6 8	
^{240}Bk	55670#	150#				4.8	m	0.8		96			β^+ ?; α=10#; β^+SF=0.0020 13	
^{240}Bk^p	55910#	180#	240#	100#					*am*					
^{240}Cf	58030#	200#				1.06	m	0.15	0^+	96	95La09	D	α≈98; SF≈2; β^+ ?	
^{240}Es	64200#	400#				1#	s						α ?; β^+ ?	

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{241}U	56200#	300#					5#	m		$7/2^+$#				β^- ?	
^{241}Np	54260	70					13.9	m	0.2	$(5/2^+)$	94			β^-=100	
^{241}Pu	52956.8	1.8					14.35	y	0.10	$5/2^+$	96			$\beta^-\approx$100; α=0.00245 2; . . .	*
^{241}Pu^m	53118.4	1.8	161.60	0.10			880	ns		$1/2^+$					
^{241}Pu^n	55160	200	2200	200			21	μs	3						
^{241}Am	52936.0	1.8					432.2	y	0.7	$5/2^-$	94			α=100; SF=4.3e–10 18; . . .	*
^{241}Am^m	55140	100	2200	100			1.5	μs							
^{241}Cm	53703.4	2.2					32.8	d	0.2	$1/2^+$	94			ε=99.0 1; α=1.0 1	
^{241}Bk	56100#	200#					4.6	m	0.4	$(7/2^+)$	94	03As01	T	α ?; β^+ ?	
^{241}Bk^p	56150#	200#	51	3	AD					$3/2^-$					
^{241}Cf	59360#	260#					3.8	m	0.7	$7/2^-$#	94			$\beta^+\approx$75; $\alpha\approx$25	
^{241}Cf^p	59510#	270#	150#	100#	Nm					$(1/2^+)$					
^{241}Es	63840#	230#					10	s	5	$(3/2^-)$	97	96Ni09	TJD	α=?; β^+ ?	
^{241}Es^p	64240#	300#	400#	200#						$(7/2^+)$					
*^{241}Pu	D : . . . ; SF<2.4e–14														**
*^{241}Am	D : . . . ; ^{34}Si<7.4e–14														**
^{242}U	58620#	200#					16.8	m	0.5	0^+	02			β^-=100	
^{242}Np	57420	200				*	2.2	m	0.2	(1^+)	02			β^-=100	
^{242}Np^m	57420#	210#	0#	50#		*	5.5	m	0.1	6^+#	02			β^-=100	
^{242}Pu	54718.4	1.9					375	ky	2	0^+	02			α=100; SF=5.50e–4 6	
^{242}Am	55469.7	1.8					16.02	h	0.02	1^-	02			β^-=82.7 3; ε=17.3 3	
^{242}Am^m	55518.3	1.8	48.60	0.05			141	y	2	5^-	02			IT$\approx$100; α=0.45 2; SF<4.7e–9	
^{242}Am^n	57670	80	2200	80			14.0	ms	1.0	$(2^+,3^-)$	02			SF$\approx$100; IT=?; α ?	
^{242}Cm	54805.2	1.8					162.8	d	0.2	0^+	02			α=100; SF=6.2e–6 3; . . .	*
^{242}Bk	57740#	200#					7.0	m	1.3	2^-#	02	80Ga07	D	$\beta^+\approx$100; β^+SF<3e–5; α ?	
^{242}Bk^m	57940#	280#	200#	200#			600	ns	100		02			SF$\approx$100; IT ?	
^{242}Bk^p	57990#	220#	250#	100#						4^-					
^{242}Cf	59340	40					3.49	m	0.15	0^+	02	70Si19	T	α=80 20; β^+ ?; SF<0.014	*
^{242}Es	64970#	330#					13.5	s	2.5		02	94Ke.B	D	α=?; β^+=?; β^+SF=0.6	*
^{242}Fm	68400#	400#					800	μs	200	0^+	02			SF=?; α ?	
*^{242}Cm	D : . . . ; ^{34}Si=1.1e–14 4; 2β^+ ?														**
*^{242}Cf	T : average 70Si19=3.68(0.44) 67Si07=3.4(0.2) 67Fi04=3.2(0.5) 67Il01=3.7(0.3)														**
*^{242}Es	D : β^+SF=0.6% assuming α and β^+ are equal														**
^{243}Np	59880#	30#					1.85	m	0.15	$(5/2^-)$	93			β^-=100	
^{243}Np^p	59925	11	50#	30#	Nm					$(5/2^-)$					
^{243}Pu	57756	3					4.956	h	0.003	$7/2^+$	93			β^-=100	
^{243}Pu^m	58140	3	383.6	0.4			330	ns	30	$(1/2^+)$	93			IT=100	
^{243}Am	57176.1	2.3					7.37	ky	0.04	$5/2^-$	93			α=100; SF=3.7e–9 2	
^{243}Cm	57183.6	2.1					29.1	y	0.1	$5/2^+$	93			$\alpha\approx$100; ε=0.29 3; SF=5.3e–9 9	
^{243}Cm^p	57312	10	129	9	AD					$7/2^+$					
^{243}Bk	58691	5					4.5	h	0.2	$(3/2^-)$	93			$\beta^+\approx$100; $\alpha\approx$0.15	
^{243}Bk^p	58740#	30#	50#	30#						$(7/2^-)$					
^{243}Cf	60950#	140#					10.7	m	0.5	$(1/2^+)$	93			$\beta^+\approx$86; $\alpha\approx$14	
^{243}Es	64780#	230#					21	s	2	$3/2^-$#	93			$\beta^+\leq$70; $\alpha\geq$30	
^{243}Es^p	65180#	310#	400#	200#						*am*					
^{243}Fm	69260#	220#					210	ms	60	$7/2^-$#	93	ABBW	D	α=60 40; β^+ ?; SF=0.57#	*
*^{243}Fm	D : α=40(20)% if α branching of ^{239}Cf is 100%, see ENSDF														**
^{244}Np	63200#	300#					2.29	m	0.16	(7^-)	03			β^-=100	
^{244}Pu	59806	5					80.0	My	0.9	0^+	03	92Mo25	D	$\alpha\approx$100; SF=0.121 4; . . .	*
^{244}Am	59881.0	2.1					10.1	h	0.1	6^-#	03			β^-=100	
^{244}Am^m	59969.5	2.3	88.6	1.7	RQ		26	m	1	1^+	03			$\beta^-\approx$100; ε=0.0361 13	
^{244}Cm	58453.7	1.8					18.10	y	0.02	0^+	03			α=100; SF=1.37e–4 3	
^{244}Cm^m	59493.9	1.8	1040.188	0.012			34	ms	2	6^+	03			IT=100	

. . . *A*-group is continued on next page . . .

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
... *A*-group continued ...															
^{244}Bk	60716	14					4.35	h	0.15	4^-#	03			β^+ ?; α=0.006 3	
^{244}Bk^p	60860#	50#	140#	50#						*am*					
^{244}Cf	61479.2	2.9					19.4	m	0.6	0^+	03			α≈100; ε ?	
^{244}Es	66030#	180#					37	s	4		03			β^+=?; α=5 3; β^+SF=0.01	
^{244}Es^p	66230#	240#	200#	150#						*am*					
^{244}Fm	69010#	280#					3.3	ms	0.5	0^+	03			SF≈100; α=0.4#	
*^{244}Pu	D : . . . ; $2\beta^-$<7.3e–9														**
*^{244}Pu	T : and $T(2\beta^-) > 1.1$ Ey, from 92Mo25; thus $2\beta^- < 7.3$ e–9%														**
^{245}Pu	63106	14					10.5	h	0.1	$(9/2^-)$	93			β^-=100	
^{245}Am	61900	3					2.05	h	0.01	$(5/2)^+$	93			β^-=100	
^{245}Cm	61004.7	2.1					8.5	ky	0.1	$7/2^+$	93			α=100; SF=6.1e–7 9	
^{245}Cm^m	61360.6	2.1	355.90	0.10			290	ns	20	$1/2^+$	93			IT=100	
^{245}Bk	61815.4	2.3					4.94	d	0.03	$3/2^-$	93			ε≈100; α=0.12 1	
^{245}Bk^p	61870#	30#	50#	30#						$(7/2^-)$					
^{245}Cf	63386.9	2.9					45.0	m	1.5	$(5/2^+)$	93			β^+=64 3; α=36 3	
^{245}Cf^p	63540#	100#	150#	100#						$7/2^+$					
^{245}Es	66440#	200#					1.1	m	0.1	$(3/2^-)$	93			β^+=60 10; α=40 10	
^{245}Es^p	66740#	220#	300#	100#						*am*					
^{245}Es^q	66790#	250#	350#	140#						*am*					
^{245}Fm	70220#	280#					4.2	s	1.3	$1/2^+$#	93			α=?; β^+=4.2#; SF=0.13#	
^{245}Md	75290#	320#				*	900	μs	250	$1/2^-$#	97	96Ni09	TJD	SF=?; α ?	
^{245}Md^m	75490#	310#	200#	100#		*	400	ms	200	$(7/2^+)$	97	96Ni09	TJD	α=?; β^+ ?	
^{246}Pu	65395	15					10.84	d	0.02	0^+	98			β^-=100	
^{246}Am	64995	18					39	m	3	(7^-)	98			β^-=100	
^{246}Am^m	65025	15	30	10			25.0	m	0.2	$2^{(-)}$	98			β^-≈100; IT<0.02	
^{246}Cm	62618.4	2.1					4.76	ky	0.04	0^+	98			α≈100; SF=0.02615 7	
^{246}Bk	63970	60					1.80	d	0.02	$2^{(-)}$	98			β^+≈100; α=0.1#	
^{246}Cf	64091.7	2.1					35.7	h	0.5	0^+	98			α=100; SF=2.5e–4 2; ε<4e–3	
^{246}Es	67900#	220#					7.7	m	0.5	4^-#	98			β^+=90.1 18; α=9.9 18; . . .	*
^{246}Es^p	68250#	300#	350#	200#						*am*					
^{246}Fm	70140	40					1.1	s	0.2	0^+	98	96Ni09	D	α=?; β^+>10; SF=4.5 13; . . .	*
^{246}Md	76280#	330#					1.0	s	0.4		98			α=?; β^+ ?; SF ?	
^{246}Md^m	76490#	340#	210	70	EU		1.0	s	0.4			96Ni09	TD	α=?; β^+ ?	*
*^{246}Es	D : . . . ; β^+SF≈0.003														**
*^{246}Fm	D : . . . ; β^+SF=10 5														**
*^{246}Md^m	I : no longer considered to exist, see ENSDF'98														**
^{247}Pu	69000#	300#					2.27	d	0.23	$1/2^+$#	93			β^-=100	
^{247}Am	67150#	100#					23.0	m	1.3	$5/2$#	93			β^-=100	
^{247}Cm	65534	4					15.6	My	0.5	$9/2^-$	93			α=100	
^{247}Bk	65491	6					1.38	ky	0.25	$(3/2^-)$	93			α≈100; SF ?	
^{247}Cf	66137	8					3.11	h	0.03	$7/2^+$#	93			ε≈100; α=0.035 5	
^{247}Es	68610#	30#					4.6	m	0.3	$7/2^+$#	93			β^+≈93; α≈7; SF≈9e–5#	
^{247}Es^p	68930#	200#	320#	200#						*am*					
^{247}Fm	71580#	140#					35	s	4	$5/2^+$#	93			α≥50; β^+≤50	
^{247}Fm^m			non existent		EU		9.2	s	2.3		93	67Fl15	I	α≈100; IT ?	*
^{247}Fm^p	71730#	170#	150#	100#	Nm					$(7/2^+)$					
^{247}Fm^q	71980#	210#	400#	150#											
^{247}Md	76040#	320#				*	270	ms	160	$1/2^-$#	93	93Ho.A	TD	SF=?; α ?	
^{247}Md^m	76170#	310#	130#	100#	Nm	*	1.12	s	0.22	$(7/2^+)$		93Ho.A	TD	α=100; SF=0.0001#	
*^{247}Fm^m	I : existence of this isomer is discussed in ENSDF														**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{248}Am	70560#	200#					3#	m			99			β^- ?	
^{248}Cm	67392	5					348	ky	6	0^+	99			α=91.61 16; SF=8.39 16; ...	*
^{248}Bk	68080#	70#				*	> 9	y		6^+#	99			α ?	
^{248}Bk^m	68110	21	30#	70#		*	23.7	h	0.2	$1^{(-)}$	99			β^-=70 5; ε=30 5; α=0.001#	
^{248}Bk^p	68130	50	50#	50#						(5^-)					
^{248}Cf	67240	5					334	d	3	0^+	99			$\alpha\approx$100; SF=0.0029 3	
^{248}Es	70300#	50#					27	m	5	2^-#,0^+#	99			$\beta^+\approx$100; $\alpha\approx$0.25; β^+SF=3e–5	
^{248}Es^m			non existent		RN		41	m				89Ha27	I		
^{248}Fm	71906	12					36	s	3	0^+	99			α=93 7; β^+=7 7; SF=0.10 5	
^{248}Md	77150#	240#					7	s	3		99			β^+=80 10; α=20 10; ...	*
^{248}Md^p	77250#	250#	100#	70#											
^{248}No	80660#	300#					< 2	μs		0^+		03Be18	I	SF ?	
*^{248}Cm	D : ... ; $2\beta^-$?														**
*^{248}Md	D : ... ; β^+SF<0.05														**
^{249}Am	73100#	300#					1#	m						β^- ?	
^{249}Cm	70750	5					64.15	m	0.03	$1/2^{(+)}$	99			β^-=100	
^{249}Cm^m	70799	5	48.758	0.017			23	μs		$(7/2^+)$	99			α=100	
^{249}Bk	69849.6	2.6					330	d	4	$7/2^+$	99			$\beta^-\approx$100; α=0.00145 8; ...	*
^{249}Bk^m	69858.4	2.6	8.80	0.10			300	μs		$(3/2^-)$	99			IT=100	
^{249}Cf	69725.6	2.2					351	y	2	$9/2^-$	99			α=100; SF=5.0e–7 4	
^{249}Cf^m	69870.6	2.2	144.98	0.05			45	μs	5	$5/2^+$	99			IT=100	
^{249}Es	71180#	30#					102.2	m	0.6	$7/2^+$	99			$\beta^+\approx$100; α=0.57 8	
^{249}Fm	73620#	100#					2.6	m	0.7	$7/2^+$#	99			β^+ ?; α=33 9	
^{249}Md	77330#	220#					24	s	4	$(7/2^-)$	99	01He35	J	α>60; β^+ ?	
^{249}Md^m	77430#	250#	100#	100#			1.9	s	0.9	$(1/2^-)$		01He35	TJD	α=100	
^{249}No	81820#	340#					57	μs	12	$5/2^+$#	99	03Be18	T	β^+ ?; α ?	
*^{249}Bk	D : ... ; SF=47e–9 2														**
^{250}Cm	72989	11					8300#	y		0^+	01			SF$\approx$74; $\alpha\approx$18; $\beta^-\approx$8	
^{250}Bk	72951	4					3.212	h	0.005	2^-	01			β^-=100	
^{250}Bk^m	72987	4	35.59	0.05			29	μs	1	(4^+)	01			IT=100	
^{250}Bk^n	73036	5	84.1	2.1	AD		213	μs	8	(7^+)	01			IT ?	
^{250}Cf	71171.8	2.1					13.08	y	0.09	0^+	01			$\alpha\approx$100; SF=0.077 3	
^{250}Es	73230#	100#				*	8.6	h	0.1	(6^+)	01			β^+>97; α ?	
^{250}Es^m	73430#	180#	200#	150#		*	2.22	h	0.05	$1^{(-)}$	01			$\beta^+\approx$100; α ?	
^{250}Fm	74074	12					30	m	3	0^+	01			α>90; ε<10; SF=0.0069 10	
^{250}Fm^m	75570#	300#	1500#	300#			1.8	s	0.1	7,8#	01			IT>80; α<20; β^+ ?; ...	*
^{250}Md	78640#	300#					52	s	6		01			β^+=93 3; α=7 3; β^+SF=0.02	
^{250}Md^p	78830#	340#	190#	150#						*am*					
^{250}No	81520#	200#					5.7	μs	0.8	0^+	01	03Be18	T	SF$\approx$100; α=0.1#; ...	*
*^{250}Fm^m	D : ... ; SF<8.2E-5														**
*^{250}No	D : ... ; β^+=0.00025#														**
*^{250}No	T : also 01Og08=36(+11–6)														**
^{251}Cm	76648	23					16.8	m	0.2	$(1/2^+)$	99			β^-=100	
^{251}Bk	75228	11					55.6	m	1.1	$3/2^-$#	99			β^-=100	
^{251}Bk^m	75264	11	35.5	1.3			58	μs	4	$7/2^+$#	99			IT=100	
^{251}Cf	74135	4					900	y	40	$1/2^+$	99			$\alpha\approx$100; SF ?	
^{251}Es	74512	6					33	h	1	$(3/2^-)$	99			ε ?; α=0.5 2	
^{251}Fm	75987	8					5.30	h	0.08	$(9/2^-)$	99			β^+=98.20 13; α=1.80 13	
^{251}Fm^m	76178	8	191	2			15.2	μs	2.3	$(5/2^+)$	99			IT=100	
^{251}Md	79030#	200#					4.0	m	0.5	$7/2^-$#	99			β^+=95#; α=?	
^{251}Md^p	79080#	210#	50#	30#						*am*					
^{251}No	82910#	180#				*	760	ms	30	$7/2^+$#	99	01He35	TD	α=83 16; β^+ ?; SF<0.3	
^{251}No^m	83030#	210#	110#	180#		*	1.7	s	1.0	$9/2^-$#		97He29	ETD	α=100	*
^{251}Lr	87900#	300#					150#	μs						β^+ ?; α ?	
*^{251}No^m	I : tentative assignment in 97He29, could not be confirmed in 01He35														**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{252}Cm	79060#	300#					<1	d		0^+	99			β^- ?	
^{252}Bk	78530#	200#					1.8	m	0.5		99	92Kr.A	TD	β^-=?; α ?	
^{252}Cf	76034	5					2.645	y	0.008	0^+	99			α=96.908 8; SF=3.092 8	
^{252}Es	77290	50					471.7	d	1.9	(5^-)	99			α=78 2; ε=22 2	
^{252}Fm	76817	6					25.39	h	0.04	0^+	99			$\alpha\approx$100; SF=0.0023 2; 2β^+ ?	
^{252}Md	80630#	200#					2.3	m	0.8		99			β^+>50; α<50	
^{252}Md^p	80670#	220#	40#	100#						*am*					
^{252}No	82881	13					2.44	s	0.04	0^+	99	01Og08	TD	$\alpha\approx$67; SF=32.2 5; β^+ ?	*
^{252}Lr	88840#	250#					390	ms	90		99	01He35	TD	β^+=71#; α=?; SF<1	
^{252}Lr^p	89140#	290#	300#	150#											
*^{252}No	T : other 03Be18=2.38(+0.26–0.22)						D : SF from 01Og08; α estimated by NUBASE								**
^{253}Bk	80930#	360#					10#	m				91Kr.A	I	β^- ?	*
^{253}Cf	79301	6					17.81	d	0.08	$(7/2^+)$	99			$\beta^-\approx$100; α=0.31 4	
^{253}Es	79013.7	2.6					20.47	d	0.03	$7/2^+$	99			α=100; SF=8.7e–6 3	
^{253}Fm	79350	4					3.00	d	0.12	$(1/2)^+$	99			ε=88 1; α=12 1	
^{253}Md	81300#	210#					12	m	8	$7/2^-$#	99			$\beta^+\approx$100; α=0.6#	
^{253}Md^p	81300#	210#	0#	30#						*am*					
^{253}No	84470#	100#					1.62	m	0.15	$9/2^-$#	99			α=?; β^+=20#; SF=0.001#	
^{253}No^m	84590#	100#	129	19	AD		31	μs		$5/2^+$#				α=?	
^{253}Lr	88690#	220#				* &	580	ms	70	$(7/2^-)$	99	01He35	TJD	α=90 10; SF=2.6 21; β^+=1#	
^{253}Lr^m	88710#	250#	30#	100#		* &	1.5	s	0.3	$(1/2^-)$	99	01He35	TJD	α=90 10; SF=8 5; β^+=1#	
^{253}Rf	93790#	450#				*	13	ms	5	$(7/2)^{(+\#)}$		95Ho.B	TJ	SF$\approx$50; $\alpha\approx$50	*
^{253}Rf^m	93990#	470#	200#	150#		*	52	μs	14	$(1/2)^{(-\#)}$	99	97He29	J	SF=?; α=5#	
*^{253}Bk	I : possible identification, in 91Kr.A. Needs confirmation														**
*^{253}Rf	I : the state with $\approx$1.8 s reported in ENSDF is not confirmed														**
^{254}Bk	84390#	300#					1#	m						β^- ?	
^{254}Cf	81341	12					60.5	d	0.2	0^+	01			SF$\approx$100; α=0.31 2; 2β^- ?	
^{254}Es	81992	4					275.7	d	0.5	(7^+)	01			$\alpha\approx$100; ε=0.03#; ...	*
^{254}Es^m	82076	3	84.2	2.5	AD		39.3	h	0.2	2^+	01			β^-=98 2; IT<3; α=0.32 1; ...	*
^{254}Fm	80904.2	2.8					3.240	h	0.002	0^+	01			$\alpha\approx$100; SF=0.0592 3	
^{254}Md	83510#	100#				*	10	m	3	(0^-)	01			$\beta^+\approx$100; α ?	
^{254}Md^m	83560#	140#	50#	100#		*	28	m	8	(3^-)	01			$\beta^+\approx$100; α ?	
^{254}No	84724	18					51	s	10	0^+	01			α=90 4; β^+=10 4; SF=0.17 5	
^{254}No^m	85220#	100#	500#	100#			280	ms	40		01			IT>80; α ?	
^{254}Lr	89850#	340#					13	s	3		01			α=76 11; β^+=24 11; SF ?	*
^{254}Lr^p	89880#	340#	30#	70#											
^{254}Rf	93320#	290#					23	μs	3	0^+	01	97He29	TD	SF=?; α<1.5	
*^{254}Es	D : ... ; β^-=1.74e–4 8; SF<3e–6														**
*^{254}Es^m	D : ... ; ε=0.076 7; SF<0.045														**
*^{254}Lr	T : also 01Ga20=13.4(4.2)														**
^{255}Cf	84810#	200#					85	m	18	$(7/2^+)$	99			β^-=100; SF<0.001#; α=2e–7#	
^{255}Es	84089	11					39.8	d	1.2	$(7/2^+)$	99			β^-=92.0 4; α=8.0 4; SF=0.0041 2	
^{255}Fm	83799	5					20.07	h	0.07	$7/2^+$	99			α=100; SF=2.4e–5 10	
^{255}Fm^p	84050#	100#	250#	100#	Nm					$(9/2^+)$					
^{255}Md	84843	7					27	m	2	$(7/2^-)$	99			β^+=92 2; α=8 2; SF<0.15	
^{255}Md^p	84850#	70#	10#	70#						*am*					
^{255}No	86854	10					3.1	m	0.2	$(1/2^+)$	99			α=61 3; β^+=39 3	
^{255}No^p	86950#	70#	100#	70#	Nm					$(7/2^+)$					
^{255}Lr	90060#	210#					22	s	4	$7/2^-$#	99			α=?; β^+<30#; SF<1#	*
^{255}Rf	94400#	180#				*	1.64	s	0.11	$9/2^-$#	99	01He35	TD	α=?; SF=52 6	
^{255}Rf^m	94320#	210#	−80#	180#		*	1.0	s	0.4	$5/2^+$#	99	97He29	D	α=100	
^{255}Db	100040#	420#					1.7	s	0.5		99			α ?; SF$\approx$20	
*^{255}Lr	T : also 01Ga20=21(8)														**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^{π}	Ens	Reference		Decay modes and intensities (%)	
^{256}Cf	87040#	300#					12.3	m	1.2	0^+	99			SF=100; α=6.2e–7#; $2\beta^-$?	
^{256}Es	87190#	100#				*	25.4	m	2.4	$(1^+,0^-)$	99			β^-=100	
^{256}Es^m	87190#	140#	0#	100#		*	7.6	h		(8^+)	99			$\beta^-\approx$100; β^-SF=0.002	
^{256}Fm	85486	7					157.6	m	1.3	0^+	99			SF=91.9 3; α=8.1 3	
^{256}Md	87620	50					77	m	2	(1^-)	99			β^+=?; α=9.2 7; SF<3	
^{256}Md^p	87700#	110#	80#	100#						*am*					
^{256}No	87824	8					2.91	s	0.05	0^+	99			$\alpha\approx$100; SF=0.53 6; ε<0.01#	
^{256}Lr	91870#	220#					27	s	3		99			α=85 10; β^+=15 10; SF<0.03	
^{256}Lr^p	91970#	230#	100	70	XL										
^{256}Rf	94236	24					6.45	ms	0.14	0^+	99	97He29	TD	SF=?; α=0.32 17	*
^{256}Db	100720#	290#					1.9	s	0.4		99	01He35	TD	α=?; β^+=36 12; SF=?	*
*^{256}Rf	T : average 97He29=6.2(0.2) 84Og02=6.7(0.2)														**
*^{256}Db	T : average 01He35=1.6(+0.5–0.3) 83Og.A=2.6(+1.4–0.8)														**
^{257}Es	89400#	410#					7.7	d	0.2	$7/2^+$#	99			β^-=100; α=4e–4#	
^{257}Fm	88589	6					100.5	d	0.2	$(9/2^+)$	99			$\alpha\approx$100; SF=0.210 4	
^{257}Md	88996.2	2.8					5.52	h	0.05	$(7/2^-)$	99			ε=85 3; α=15 3; SF<4	
^{257}No	90241	22					25	s	2	$(7/2^+)$	99	02Ho11	D	α=?; β^+=15 8	
^{257}No^p	90550#	110#	310#	100#						*am*					
^{257}Lr	92740#	210#					646	ms	25	$9/2^+$#	99			$\alpha\approx$100; β^+=0.01#; SF=0.001#	
^{257}Lr^p	92890#	230#	150#	100#						*am*					
^{257}Rf	95930#	100#					4.7	s	0.3	$(1/2^+)$	99	97He29	JD	α=?; β^+=11 1; SF<1.4	
^{257}Rf^m	96050#	100#	114	17	AD		3.9	s	0.4	$(11/2^-)$	99	97He29	EJ	$\alpha\approx$100; SF=0.7#; β^+ ?	*
^{257}Rf^p	96030#	120#	100#	70#						$(7/2^+)$					
^{257}Db	100340#	230#				* &	1.53	s	0.17	$(9/2^+)$	99	01He35	TJD	α>94; SF<6; β^+=1#	
^{257}Db^m	100450#	250#	100#	100#		* &	790	ms	130	$(1/2^-)$	99	01He35	TJD	α>87; SF<13; β^+=1#	
*^{257}Rf^m	E : 97He29=118(4) keV form direct comparison of two alpha lines														**
^{258}Es	92700#	300#					3#	m						β^- ?; α ?	
^{258}Fm	90430#	200#					370	μs	14	0^+	01	86Hu05	T	SF$\approx$100; α ?	*
^{258}Md	91688	5				*	51.5	d	0.3	8^-#	01	93Mo18	D	$\alpha\approx$100; β^+<0.0015; β^-<0.0015	*
^{258}Md^m	91690#	200#	0#	200#		*	57.0	m	0.9	1^-#	01	93Mo18	D	ε=?; SF<20; β^-<10#; α<1.2	*
^{258}No	91480#	200#					1.2	ms	0.2	0^+	01			SF$\approx$100; α=0.001#; $2\beta^+$?	
^{258}Lr	94840#	100#					4.1	s	0.3		01			α>95; β^+<5	
^{258}Lr^p	95040#	180#	200#	150#						*am*					
^{258}Rf	96400#	200#					12	ms	2	0^+	01			SF=87 2; α=13 2	
^{258}Db	101750#	340#				*	4.5	s	0.6		01			α=64 7; β^+=36 7; SF<1#	
^{258}Db^m	101810#	350#	60#	100#		*	20	s	10		01			$\beta^+\approx$100; IT ?	
^{258}Sg	105420#	410#					3.3	ms	1.0	0^+	01			SF=?; α<20	
*^{258}Fm	T : average 86Hu05=360(20) 71Hu03=380(20) (all 1σ) ENSDF gives 3σ														**
*^{258}Md	D : derived from: "the sum of SF, ε and β^- decay branches < 0.003%" in														**
*^{258}Md	D : 93Mo18 and T(SF)>150000 y, from 86Lo16, thus SF<1e–4%#														**
*^{258}Md^m	D : SF<20% derived from 93Mo18 "the sum of SF and β^- decay branches < 30%"														**
^{259}Fm	93700#	280#					1.5	s	0.3	$3/2^+$#	99			SF=100	
^{259}Md	93620#	200#					1.60	h	0.06	$7/2^-$#	99	93Mo18	T	SF=?; α<1.3	
^{259}No	94110#	100#					58	m	5	$9/2^+$#	99			α=75 4; ε=25 4; SF<10	
^{259}No^p	94390#	180#	280#	150#											
^{259}Lr	95850#	70#					6.2	s	0.3	$9/2^+$#	99			α=78 2; SF=22 2; β^+=0.6#	
^{259}Lr^p	96200#	170#	350#	150#											
^{259}Rf	98400#	70#					2.8	s	0.4	$7/2^+$#	99	94Gr08	T	α=92 2; SF=8 2; β^+=0.3#	*
^{259}Rf^p	98500#	100#	100#	70#	Nm					$(3/2^+)$					
^{259}Rf^q	98610#	130#	210#	110#	Nm					$(9/2^+)$					
^{259}Db	102100#	210#					510	ms	160		99	01Ga20	TD	α=100	
^{259}Sg	106660#	180#					580	ms	210	$1/2^+$#	99			α=90 10; SF<20	
*^{259}Rf	T : average 94Gr08=1.7(+0.8–0.5) 85So03=3.4(1.7) 81Be03=3.0(1.3)														**
*^{259}Rf	T : 73Dr10=3.2(0.8) and 69Gh01=3.2(0.8)														**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{260}Fm	95640#	500#			EU		1#	m		0^+				SF ?	*
^{260}Md	96550#	320#					27.8	d	0.8		99	92Lo.B	TD	SF=?; α<5; ε<5; β^-<3.5	*
^{260}No	95610#	200#					106	ms	8	0^+	99			SF=100	
^{260}Lr	98280#	120#					3.0	m	0.5		99			α=80 20; β^+=20 20	
^{260}Rf	99150#	200#					21	ms	1	0^+	99			SF=?; α=2#; ε=0.01#	
^{260}Db	103680#	230#					1.52	s	0.13		99			α≥90.4 6; SF≤9.6 6; β^+<2.5	
^{260}Db^p	103880#	280#	200#	150#											
^{260}Sg	106580	40					3.8	ms	0.8	0^+	99			SF=60 30; α=40 30	
^{260}Bh	113610#	580#					300#	μs			99			α=100	
*^{260}Fm	I : half-life ≈4 ms and SF=100 mode were reported in the 92Lo.B internal														**
*^{260}Fm	I : report. Not confirmed in subsequent experiment by same group (97Lo.A)														**
*^{260}Fm	I : Discovery of this nuclide is considered unproven														**
*^{260}Md	T : supersedes 86Hu01=31.8(0.5) of same group														**
^{261}Md	98480#	650#					40#	m		$7/2^-$#				α ?	
^{261}No	98500#	300#					3#	h		$3/2^+$#				α ?	
^{261}Lr	99560#	200#					39	m	12		99			SF=?; α ?	
^{261}Rf	101315	29				* &	5.5	s	2.5	$3/2^+$#	99	02Ho11	T	α=?; SF=40	
^{261}Rf^m	101390#	100#	70#	100#		* &	81	s	9	$9/2^+$#		02Ho11	TD	α=?; β^+<15; SF<10	
^{261}Rf^p	101420	70	100	60	AD					$3/2^+$#					
^{261}Db	104380#	230#					1.8	s	0.4		99			α>82; SF<18	
^{261}Sg	108160#	130#					230	ms	60	$7/2^+$#	99			α≈100; SF<1	
^{261}Sg^p	108290#	140#	130	50	AD					$(9/2^+)$					
^{261}Sg^q	108320#	140#	160	50	AD					$(3/2^+)$					
^{261}Bh	113330#	230#					13	ms	4		99			α=95 5; SF<10	
^{262}Md	101410#	580#					3#	m						SF ?; α ?	
^{262}No	99950#	450#					5	ms		0^+	01			SF≈100; α ?	
^{262}Lr	102120#	200#					4	h			01			β^+=?; SF<10; α ?	
^{262}Rf	102390#	280#				*	2.3	s	0.4	0^+	01			SF≈100; α<0.8	
^{262}Rf^m	102990#	490#	600#	400#		*	47	ms	5	high		96La11	I	SF=100	*
^{262}Db	106270#	180#					35	s	5		01			α≈67; SF≈30; β^+=3#	
^{262}Db^p	106390#	200#	120#	70#										α ?	
^{262}Sg	108420#	280#					8	ms	3	0^+	01	01Ho06	TD	SF=?; α<22	
^{262}Bh	114470#	350#					290	ms	160		01	97Ho14	T	α=?; SF<20	*
^{262}Bh^m	114780#	350#	300	60	AD		14	ms	4		01	97Ho14	T	α=?; SF<10	*
*^{262}Rf^m	I : assigned by 96La11 to K-isomeric state														**
*^{262}Bh	T : 3 events at 225, 255 and 278 ms yielding 175(+240–64), see 84Sc13														**
*^{262}Bh^m	T : 11 events yielding 12.2(+5.5–2.8)														**
^{263}No	102980#	490#					20#	m						α ?; SF ?	
^{263}Lr	103670#	360#					5#	h						α ?	
^{263}Rf	104840#	180#					11	m	3	$3/2^+$#	99	93Gr.C	TD	SF=?; α=30	*
^{263}Db	107110#	170#					29	s	9		99	92Kr01	D	SF=56 14; α=?; β^+=6.9 16	*
^{263}Db^p	107510#	260#	400#	200#											
^{263}Sg	110220#	120#				*	1.0	s	0.2	$9/2^+$#	99			α>70; SF ?	
^{263}Sg^m	110320#	100#	100#	70#	Nm	*	120	ms		$3/2^+$#	99			α=?; IT ?	
^{263}Bh	114610#	370#					200#	ms			99			α ?	
^{263}Hs	119750#	350#					1#	ms		$7/2^+$#	99			α=100	
^{263}Hs^p	120250#	360#	500#	100#						*am*				α ?; SF ?	
*^{263}Rf	T : average 03Kr.1=24(+19–7) m 93Gr.C=500(+300–200) s 92Cz.A=600(+300–200) s														**
*^{263}Db	D : SF from 92Kr01=57(+13–15); β^+ average 03Kr.1=3(+4–1) 93Gr.C=8(2)														**
*^{263}Db	T : Possibly a candidate for the 54(+98–21) s SF decay observed by 98Ik02														**

Nuclide	Mass excess (keV)		Excitation energy(keV)			Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{264}No	104650#	640#				1#	m		0^+				α ?; SF ?	
^{264}Lr	106230#	440#				10#	h						α ?; SF ?	
^{264}Rf	106180#	450#				1#	h		0^+				α ?	
^{264}Db	109360#	230#				3#	m						α ?	
^{264}Sg	110780#	280#				400#	ms		0^+	99			α ?	
^{264}Bh	116070#	280#				1.3	s	0.5		99	02Ho11	T	α=?; β^+ ?	*
^{264}Bh^p	116370#	310#	300#	150#					*am*					
^{264}Hs	119600	40				540	μs	300	0^+	99	95Ho.B	T	$\alpha\approx$50; SF$\approx$50	*
*^{264}Bh	T : mean lifetime of 6 events 1.5 s													**
*^{264}Hs	T : 95Ho.B (2 events 76 μs and 825 μs) 87Mu15 (1 event 80 μs). Average of													**
*^{264}Hs	T : the 3 events: 327(+448–120) μs, see 84Sc13													**
^{265}Lr	107900#	710#				10#	h						α ?; SF ?	
^{265}Rf	108710#	420#				13	h		$3/2^+$#	00	99Og.A	TD	α ?	*
^{265}Db	110480#	280#				15#	m						α ?	
^{265}Sg	112820	60				8	s	3	$3/2^+$#	99			α>50; SF ?	
^{265}Sg^p	113120#	120#	300#	100#					$11/2^-$#					
^{265}Bh	116570#	380#				500#	ms						α ?	
^{265}Hs	121170#	140#				2.1	ms	0.3	$9/2^+$#	99			$\alpha\approx$100; SF<1	
^{265}Hs^m	121480#	140#	300	70	AD	780	μs	150	$3/2^+$#	99			$\alpha\approx$100; IT ?	
^{265}Mt	126820#	460#				2#	ms						α ?	
*^{265}Rf	T : one case only after a 1.3 h measurement													**
^{266}Lr	111130#	660#				1#	h						α ?; SF ?	
^{266}Rf	109880#	540#				10#	h		0^+				α ?; SF ?	
^{266}Db	112740#	360#				20#	m						α ?; SF ?	
^{266}Sg	113700#	290#				21	s	6	0^+	01	98Tu01	T	α=34 9; SF=66 9	*
^{266}Bh	118250#	200#				5	s	3		01			$\alpha\approx$100; β^+ ?; SF ?	*
^{266}Hs	121190#	280#				2.7	ms	1.0	0^+	01	01Ho06	TD	α=?; SF$\approx$1.4#	
^{266}Mt	127890#	350#				1.2	ms	0.4		01	84Og03	D	α=?; SF<5.5	*
^{266}Mt^m	129120#	350#	1230	80	AD	6	ms	3		01	97Ho14	TD	α=100	*
*^{266}Sg	T : average 98Tu01=21(+20–12) 94La22=10-30 D : from 18%<α<50% 50%<SF<82%													**
*^{266}Bh	T : from T=1–10; estimated 1# s from systematics													**
*^{266}Mt	T : 10 events yielding 1.01(+0.47–0.24)													**
*^{266}Mt^m	T : 3 events at 7.8, 2.0 and 5.0 yield 3.4(+4.7–1.3)													**
^{267}Rf	113200#	580#				5#	h						α ?; SF ?	
^{267}Db	113990#	470#				2#	h						α ?; SF ?	
^{267}Sg	115900#	270#				19	ms				99Og.B	T	α=100	
^{267}Bh	118910#	260#				22	s	10			00Wi15	TD	α=100	
^{267}Hs	122760#	100#				32	ms	15	$3/2^+$#	00			α=100	
^{267}Hs^m			non existent		EU	200	ms				95Ho.A	TDI	α=?; IT ?	*
^{267}Mt	127900#	540#				10#	ms						α ?	
^{267}Ea	134450#	370#				10	μs	8	$9/2^+$#	00	95Gh04	T	α=100	*
*^{267}Hs^m	I : tentative only													**
*^{267}Ea	T : one single event, lifetime 4 μs, thus T=2.8(+13.0–1.3), see 84Sc13													**
^{268}Rf	115170#	710#				1#	h		0^+				α ?; SF ?	
^{268}Db	116850#	530#				6#	h						α ?; SF ?	
^{268}Sg	117000#	540#				30#	s		0^+				α ?; SF ?	
^{268}Bh	120870#	380#				25#	s						α ?; SF ?	
^{268}Hs	123110#	410#				2#	s		0^+				α ?	
^{268}Mt	129220#	320#				53	ms	21	5^+#,6^+#	00	02Ho11	T	α=100	*
^{268}Mt^p	129470#	330#	250#	100#									α ?; SF ?	
^{268}Ea	133940#	500#				100#	μs		0^+				α ?	
*^{268}Mt	T : mean lifetime of 6 events 60 ms													**

Nuclide	Mass excess (keV)		Excitation energy(keV)				Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{269}Db	118730#	770#					3#	h						α ?; SF ?	
^{269}Sg	119930#	660#					35	s	23		00			α<100; SF ?	
^{269}Bh	121740#	410#					25#	s						α ?	
^{269}Hs	124870#	120#					27	s	17		00	02Ho11	T	α=100	*
^{269}Mt	129530#	550#					200#	ms						α ?	
^{269}Ea	135180#	140#					230	μs	110	$3/2^+$#	00	95Ho03	T	α=100	
*^{269}Hs	T : 2 events at 19.7 and 22.0 s yield 14(+26–6)														**
^{270}Db	121760#	720#					1#	h						α ?; SF ?	
^{270}Sg	121400#	620#					10#	m		0^+				α ?; SF ?	
^{270}Bh	124460#	470#					30#	s						α ?; SF ?	
^{270}Hs	125430#	290#					30#	s		0^+		01Tu.B	D	α=100	
^{270}Mt	131020#	540#					2#	s						α ?	
^{270}Ea	134810#	290#					160	μs	100	0^+		01Ho06	TD	$\alpha\approx$100; SF$\approx$0.2	
^{270}Ea^m	135940#	290#	1140	70			10	ms	6	$(10)^{(-\#)}$		01Ho06	ETJ	α=?; IT ?	
^{271}Sg	124330#	650#					2#	h						α ?; SF ?	
^{271}Bh	125920#	560#					40#	s						α ?; SF ?	
^{271}Hs	128230#	340#					40#	s						α ?; SF ?	
^{271}Mt	131470#	570#					5#	s						α ?	
^{271}Ea	136060#	110#				*	210	ms	170	$11/2^-$#	00			α=100	
^{271}Ea^m	136090#	110#	29	29	AD	*	1.3	ms	0.5	$9/2^+$#	00			α=100	
^{272}Sg	125900#	770#					1#	h		0^+				α ?; SF ?	
^{272}Bh	128580#	610#					2#	m						α ?; SF ?	
^{272}Hs	129530#	580#					40#	s		0^+				α ?; SF ?	
^{272}Mt	133890#	480#					10#	s						α ?; SF ?	
^{272}Ea	136290#	650#					1#	s		0^+				SF ?	
^{272}Eb	143090#	330#					2.0	ms	0.8	5^+#,6^+#	00	02Ho11	T	α=100	*
*^{272}Eb	T : mean lifetime of 6 events 2.3 ms														**
^{273}Sg	128750#	660#					1#	m						SF ?	
^{273}Bh	130050#	830#					90#	m						α ?; SF ?	
^{273}Hs	132260#	830#			RN		50#	s		$3/2^+$#	00	02Ni10	I	α ?	*
^{273}Mt	134990#	510#					20#	s						α ?; SF ?	
^{273}Ea	138670#	130#					360	μs	280	$13/2^-$#	00			α=100	
^{273}Ea^m	138870#	130#	198	20	EU		120	ms		$3/2^+$#	00			α=100	
^{273}Ea^p	138950#	130#	290	40	AD									α ?; SF ?	
^{273}Eb	143150#	610#					5#	ms						α ?	
*^{273}Hs	T : 99Ni03=1.2(+1.7–0.6) alpha decay retracted by authors in 02Ni10														**
^{274}Bh	132680#	780#					90#	m						α ?; SF ?	
^{274}Hs	133330#	650#					1#	m		0^+				α ?; SF ?	
^{274}Mt	137390#	560#					20#	s						α ?; SF ?	
^{274}Ea	139250#	490#					2#	s		0^+				α ?; SF ?	
^{274}Eb	145050#	620#					5#	ms						α ?	
^{275}Bh	134370#	650#					40#	m						SF ?	
^{275}Hs	135950#	710#					30#	m						α ?; SF ?	
^{275}Mt	138460#	590#					30#	s						α ?; SF ?	
^{275}Ea	141750#	450#					2#	s						α ?; SF ?	
^{275}Eb	145450#	690#					10#	ms						α ?	

Nuclide	Mass excess (keV)		Excitation energy(keV)	Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{276}Hs	137120#	820#		1#	h		0^+				α ?; SF ?	
^{276}Mt	140800#	680#		40#	s						α ?; SF ?	
^{276}Ea	142550#	610#		5#	s		0^+				α ?; SF ?	
^{276}Eb	147640#	630#		100#	ms						α ?; SF ?	
^{277}Hs	139580#	730#		40	m	30	$3/2^+$#	00	99Og10	TD	SF=100	*
^{277}Mt	141980#	880#		1#	m						α ?; SF ?	
^{277}Ea	144980#	960#	RN	5#	s		$11/2^+$#	00	02Ni10	I	α ?	*
^{277}Eb	148590#	620#		1#	s						α ?; SF ?	
^{277}Ec	152710#	130#		1.1	ms	0.7	$3/2^+$#	00	02Ho11	T	α=100	*
*^{277}Hs	T : one single event 16.5 m yields 11(+55–5)											**
*^{277}Ea	T : 99Ni03=3.0(+4.7–1.5) alpha decay retracted by authors in 02Ni10											**
*^{277}Ec	T : two events at 0.280 ms and 1.406 ms											**
^{278}Mt	144210#	840#		30#	m						α ?; SF ?	
^{278}Ea	145750#	680#		10#	s		0^+				α ?; SF ?	
^{278}Eb	150530#	630#		1#	s						α ?; SF ?	
^{278}Ec	153060#	530#		10#	ms		0^+				α ?; SF ?	
^{279}Mt	145490#	720#		6#	m						α ?; SF ?	
^{279}Ea	147980#	740#		10#	s						α ?; SF ?	
^{279}Eb	151340#	660#		3#	s						α ?; SF ?	
^{279}Ec	155140#	490#		100#	ms						α ?; SF ?	
^{280}Ea	148850#	850#		11	s	6	0^+		01Og01	TD	SF=100	*
^{280}Eb	153210#	740#		10#	s						α ?; SF ?	
^{280}Ec	155600#	640#		1#	s		0^+				α ?; SF ?	
*^{280}Ea	T : 3 events at 6.93, 14.3 and 7.4 yield 6.6(+9–2.4)											**
^{281}Ea	150960#	730#		4	m	3	$3/2^+$#	00	99Og10	TD	α=100	*
^{281}Eb	154040#	930#		1#	m						α ?; SF ?	
^{281}Ec	157690#	990#	RN	10#	s		$3/2^+$#	00	02Ni10	I	α ?	*
*^{281}Ea	T : one single event 1.6 m yields 1.1(+5.3–0.5), see 84Sc13											**
*^{281}Ec	T : 99Ni03=0.89(+1.30–0.45) alpha decay retracted by authors in 02Ni10											**
^{282}Eb	156010#	890#		4#	m						α ?; SF ?	
^{282}Ec	158140#	710#		30#	s		0^+				α ?; SF ?	
^{283}Eb	156880#	780#		10#	m						α ?; SF ?	
^{283}Ec	160020#	770#		4.2	m	2.1			99Og05	TD	SF=100	*
^{283}Ed	164360#	730#		10#	s						α ?; SF ?	
*^{283}Ec	T : 4 events at 99Og07=9.3 m, 3.8 m, 99Og05=3.0 m and 0.9 m yield 3(+3–1) m											**
^{284}Ec	160570#	850#		31	s	18	0^+		01Og01	TD	α=100	
^{284}Ed	165880#	800#		1#	m						α ?; SF ?	
^{285}Ec	162180#	730#		40	m	30	$5/2^+$#	00	99Og10	TD	α=100	*
^{285}Ed	166490#	980#		2#	m						α ?; SF ?	
^{285}Ee	171110#	1030#	RN	5#	s		$3/2^+$#	00	02Ni10	I	α ?	*
*^{285}Ec	T : one single event 15.4 s yields 11(+51–5), see 84Sc13											**
*^{285}Ee	T : 99Ni03=580(+870–290) alpha decay retracted by authors in 02Ni10											**

Nuclide	Mass excess (keV)		Excitation energy(keV)	Half-life			J^π	Ens	Reference		Decay modes and intensities (%)	
^{286}Ed	168120#	940#		5#	m						α ?; SF ?	
^{286}Ee	171260#	770#		5#	s		0^+				α ?; SF ?	
^{287}Ed	168640#	830#		20#	m						α ?; SF ?	
^{287}Ee	172880#	770#		10	s	7			99Og07	T	α=100	$*$
^{287}Ef	178090#	790#		500#	ms						α ?; SF ?	
$*^{287}$Ee	T : 2 events at 1.32 s and 14.4 s yield 5.5(+10–2)											$**$
^{288}Ee	172970#	850#		2.8	s	1.4	0^+		01Og01	TD	α=100	
^{288}Ef	179310#	850#		1#	s						α ?; SF ?	
^{289}Ee	174450#	730#		80	s	60	$5/2^+$#	00	99Og10	TD	α=100	$*$
^{289}Ef	179510#	1020#		10#	s						α ?; SF ?	
^{289}Eg	185240#	1090#	RN	10#	ms		$5/2^+$#	00	02Ni10	I	α ?	$*$
$*^{289}$Ee	T : one single event at 30.4 s yields 21(+101–10)											$**$
$*^{289}$Eg	T : 99Ni03=600(+860–300) alpha decay retracted by authors in 02Ni10											$**$
^{290}Ef	180840#	980#		10#	s						α ?; SF ?	
^{290}Eg	184990#	840#		50#	ms		0^+				α ?; SF ?	
^{291}Ef	181070#	890#		1#	m						α ?; SF ?	
^{291}Eg	186310#	850#		100#	ms						α ?; SF ?	
^{291}Eh	192410#	880#		10#	ms						α ?; SF ?	
^{292}Eg	186100#	850#		120	ms	100	0^+		01Og01	TD	α=100	$*$
^{292}Eh	193330#	940#		50#	ms						α ?; SF ?	
$*^{292}$Eg	T : one single event at 46.9 ms yields 33(+155–15)											$**$
^{293}Ei	199960#	1200#	RN	5#	ms		$1/2^+$#	00	02Ni10	I	α ?	$*$
$*^{293}$Ei	T : 99Ni03=120(+180–60) alpha decay retracted by authors in 02Ni10											$**$